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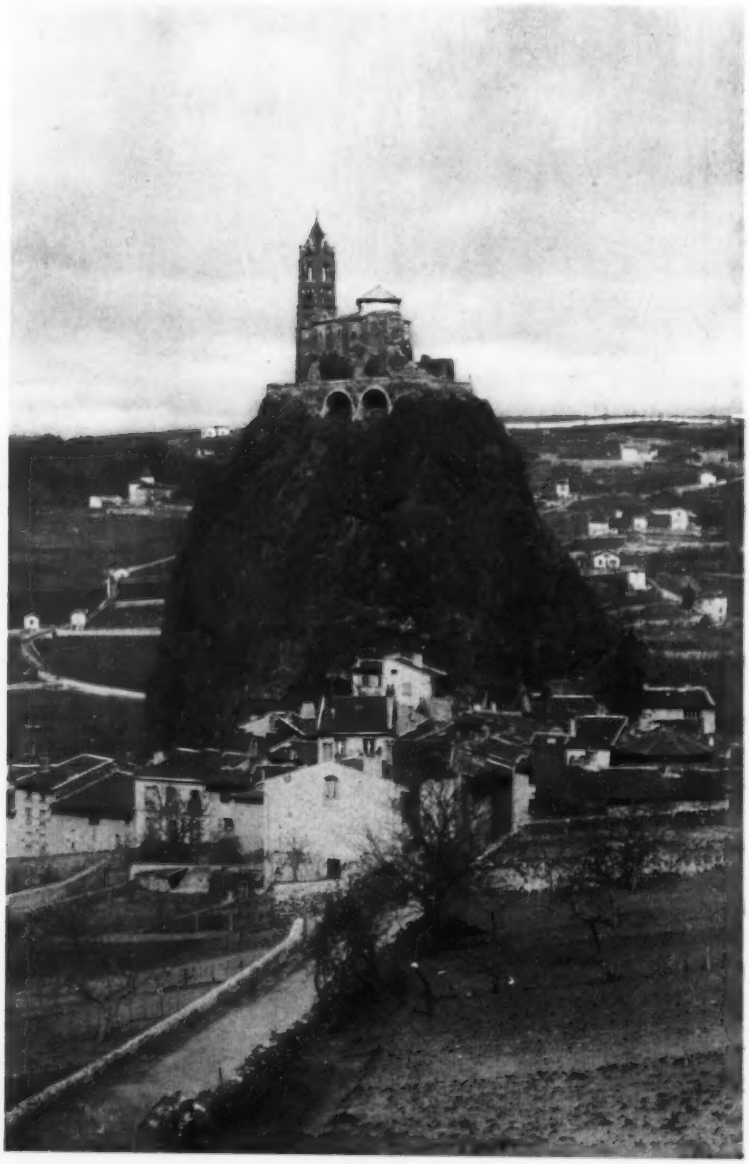

LE PUY.

The
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VOL. XII. SEPTEMBER, 1902. No. 4.

MODERN ITALIAN ARCHITECTURE.

I COME now to the second part* of my paper on Modern Architecture in Italy, on the architecture of private buildings. This subject must be presented by districts, for, if there is any branch of architecture which has kept free from academic influence, it is private residences. Our art schools like to keep the tone of their instruction upon a very high level, and the houses of the middle class are not worthy of the solemnity of their teaching, which is chiefly influential in monumental architecture. By the side of this architecture, æsthetically empty, there rises the private residence, less solemn, but more sincere, which in Italy changes as you pass from north to south.

This residence architecture may be divided into two groups: On one side we have apartment houses, on the other private dwellings, palazzi, and villas. In Italy as elsewhere the artistic quality of the second of these groups is very much better than that of the first, but houses of both kind have been in demand since the renewal of building in Italy, and both kinds had to be supplied. But before I enter into a description of particular buildings, the general conditions, which prompted this renewal of building, and which were largely the outcome of the political revolution, should be explained.

That the political revolution resulted in equally revolutionary changes in the architecture and building of Italian cities was due to the fact that the former governments entirely neglected the questions of rural sewerage, drainage, and transit. Our largest cities, Florence, Venice, Genoa, Rome, Naples, Palermo were so many congested, infected and loathsome spots. Not even at present have the problems regarding public works so far as they concern private architecture been solved entirely; and Milan, the most active and most enterprising city of Italy, the city where the social problems are discussed with the utmost precision, has insalubrious localities condemned to be demolished, but not as yet demolished. I must add that, Mantua, quite close to Milan, a city which in the history of the Renaissance played one of the leading parts, has not yet lost its ancient "Ghetto," a place which was formerly occupied

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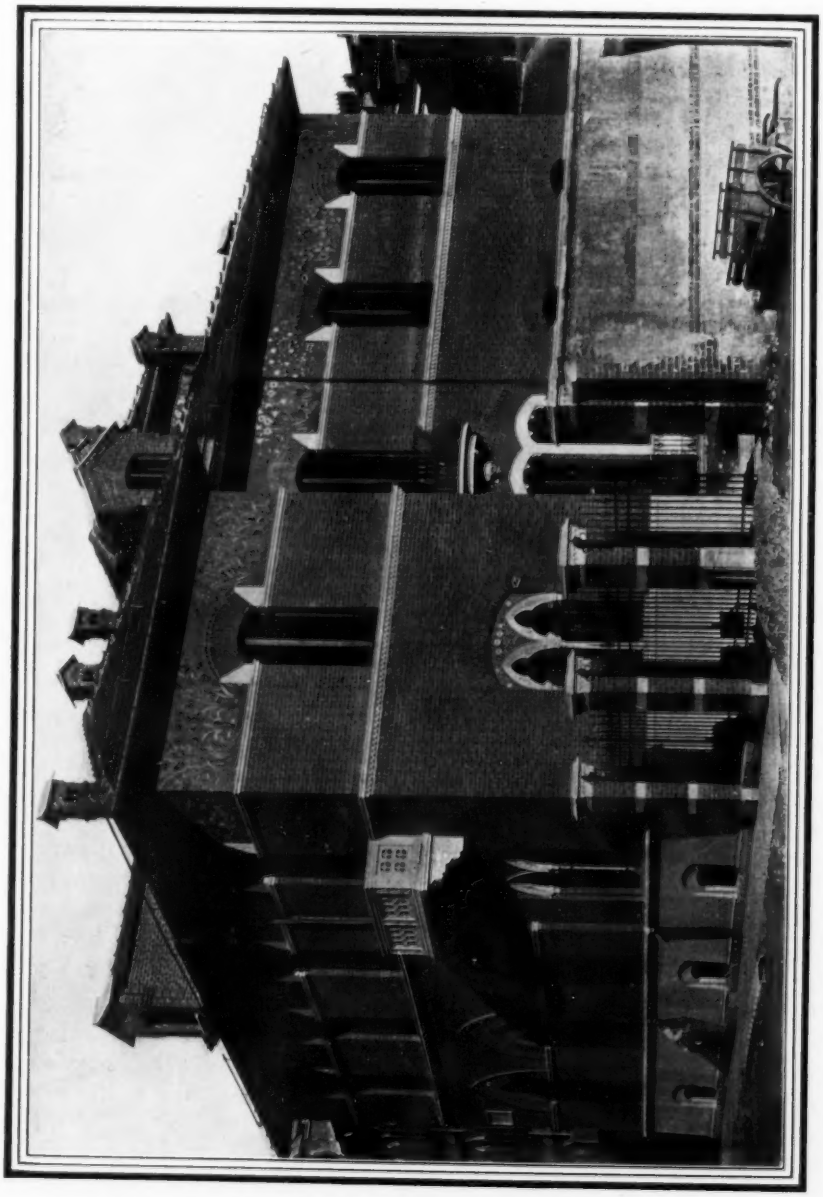
by the Jews, and which represents the most disgraceful evils imaginable; and this in the very centre of the city.

The problems of improving the sanitary condition of Italian cities, which is necessarily associated with the development of residence architecture, are both interesting and difficult. They have occupied the attention of our most distinguished social students; and many designs have been submitted for the purpose of reconciling hygienic improvements with a proper respect for historical monuments. In the case of Florence, for instance, the problem was particularly acute, because the centre of old Florence, around the market place was from a sanitary point of view in a deplorable condition; and when the proposal was made to introduce desirable hygienic improvements, several different parties came to the front—among which was one group that would improve everything regardless of historical monuments, and at the other extreme a group, consisting mostly of foreigners, who did not want a stone to be changed. As a matter of fact it was the first group that had their way, and their way was bad for the new centre of Florence. The sewered and drained centre of the Athens of modern Italy, does no honor to Italian architecture. Leaving aside the triumphal arch, which was illustrated in the first of my papers, and limiting myself to private buildings of the present, I must assert that Florentine architects are deficient in imagination. They have more than their share of the traditionalism which infects Italian blood. If they have to erect a monumental palace they cling to the design of Palazzo Strozzi; if a residence or country house is wanted, they fall back upon the style of Brunnelleshi, and compose a façade, exhibiting an absolute respect for straight line and symmetry. The façade always has the round door in the centre, and on the sides windows decorated with pediments, while on the second and third floors, the windows are likewise adorned alternately with rectangular or curvilinear pediments. The ensemble is sometimes pretty, but eternally the same—pretty also, because of that pietra serena, a stone of bluish color, which has been adopted by the Florentine architects, and which gives the buildings a charm and decorative accent of an original and local beauty. But these architects are timid; they have no force and inspiration. When they were forced by the building problems connected with the new centre of Florence to design apartment-houses of many stories they turned to Milan, where everything connected with modern life receives the stamp of richness and grandeur.

People, however, who wish to study modern Florentine architecture at its best, should go to the less recent parts of the city, the "Viale dei Colli," and the "Lungarno." In the neighborhood of the Jewish temple, already published in this magazine, they will find



MAISON MARIETTA.

S. Molli, Architect.

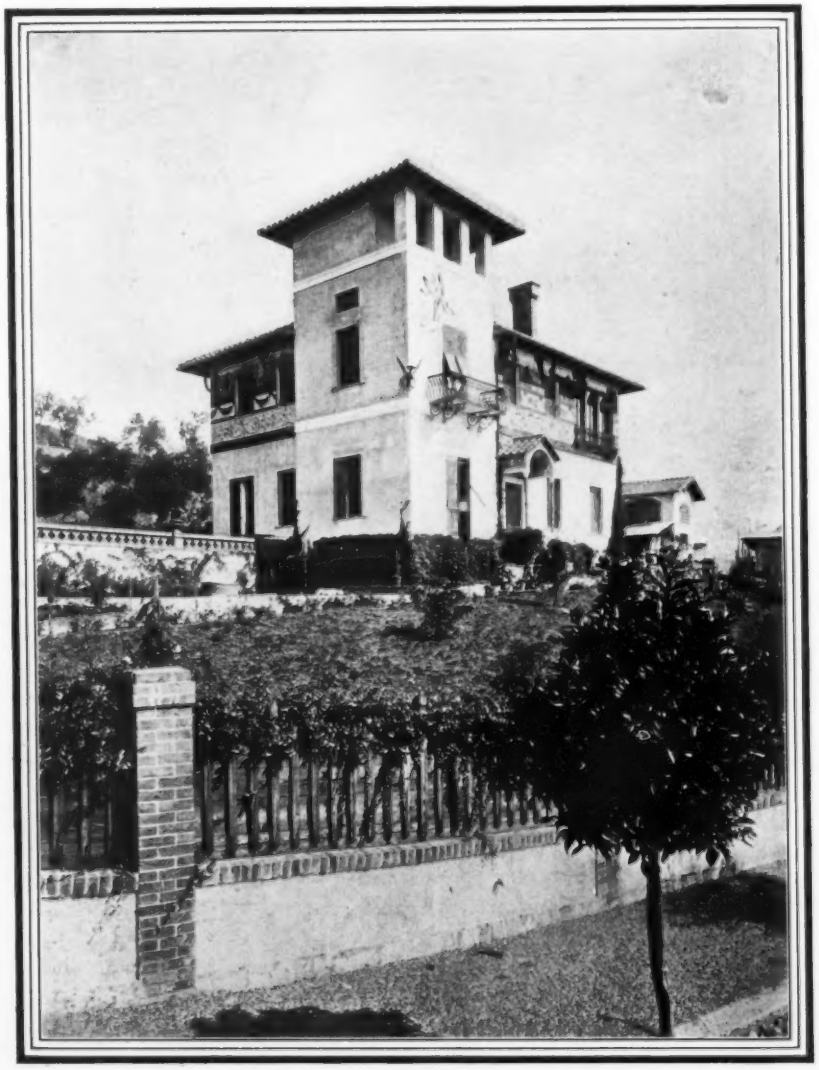
Turin.

broad streets, and a fine square, called the Piazza d'Azeglio, with many pretty houses roundabout, and villini or cottages. The little houses on the Viale dei Colli look, surrounded as they are by pretty garden plots, like flowers set in verdure. One of the most charming of them is the Villa Oppenheim, where the Empress Eugenie and Prince Napoleon lived in 1876. You must not expect to find in the palaces of the Lungarno and in these cottages the picturesque and vivacious lines of the pretty English and North American cottages. The Italian architecture, as a rule, is hostile to vivacity; and if just at present, some architects, instigated by the English fashion, which is getting hold of our country, try to enliven the outlines of the buildings, they are introducing a system entirely outside of the Italian custom and altogether recent. Thus no important constructive problem is taken up by our architects.

In Venice the new building movement has not had as much chance to construct or to destroy as it has elsewhere; but even here the partisans of the straight line have been doing a great deal of harm. Truth to tell the city of Venice is losing that local color which is its principal merit; and the modern architects are less mindful than they ought to be of the integrity of their city. I say the architects, but I might say, the Venetians; and, frankly, Venice, instead of rising out of the waters gay and full of charms, as she did in former days, seems nowadays to emerge gray and dirty from a muddy flood. One need only look around while passing over the "Canale Grande" in a steam launch, the "Vaporetto," to be convinced that Venice is passing away. Even the Municipal Palaces are disfigured, and if I were to write on the present Venice, instead of writing to you on the private buildings of modern Italy, I could tell you a good many things about it. It is enough here to say that the Technical Bureau of Venice, attached to the city administration, has not one architect among its staff. All questions that are dealt with are of technical and administrative character; art is absolutely subordinated to mechanical questions. And this in a city like Venice, and in an office which should direct the building tendencies of a place which owes its celebrity in this world to the beauty and plasticity of its architectonic forms. Just at present a new bridge had been projected over one of the lagoons in Venice. This project, like everything else serving to disfigure the city, has its partisans and its opponents; its partisans are recruited among those who care for "business" and who have less than little interest in the artistic integrity of the city; the adversaries are made up of artists, literary men, who cultivate the beautiful and loathe "business." It looks as if the latter will this time carry the day against the utilitarians, and, as an Italian proverb says: "If there are roses, we shall see them blossom."

In the city of Genoa the utilitarian spirit prevails. A great deal of money has been spent on new buildings, but the Genoese merchants and mariners are indifferent to beauty, and the result is unmentionable. But "La Superba" holds an important place in the architecture of the "villini," and the natural beauty of the two "Reviere" between which the city extends has been well used by several architects, who have built many country houses facing the sea and surrounded by a wonderful vegetation. As an example of these I take pleasure in showing you a villa, which has been designed to animate its surroundings with a picturesque silhouette, and to harmonize with the shrubbery and landscape, as a kiss unites mother and son. This Villa Schmidt is the excellent work of F. M. Parodi, one of the architects of the chateau called Montegalletto at Genoa, and it must appeal to all those who like beauty in simplicity. I am very glad that its author, my worthy friend, has given me permission to publish it here; and I have only to regret that I cannot reproduce the color with the outline and mass. It is not by chance that I place by the side of it another painted "villino," that of the Casa Marietta at Turin, which was designed by the architect S. Molli, and possesses something of the same feeling. It must not be supposed, however, that these two examples of colored houses are typical. Italian architects, although they have before their eyes, the façades of Venice, Verona and Mantua have shut their eyes to the charms of polychromy. I may add that the Turin villa cost $12,000 in American money, and the house adjoining it, used as a printing office, $8,000 more.

I have named Rome, the capital of Italy, which, since 1870 when the temporal power of the Pope fell, has been remodelled in several parts and has laid out new roads, so that now a third Rome has been built by the side of the Imperial Rome and the City of the Popes; and it is no exaggeration to say that the private architecture is here superior in interest to the monumental architecture. I have said before that the style of modern architecture at Rome is Roman and Bramantesque. The most gifted architects are here so entirely under the van of Roman and Bramantesque power that even with compass in hand, they cannot get away from the influence of these suggestions. Among the recently opened streets in the modern Rome, the "Via Nazionale" is the most remarkable and characteristic one. Rich in new palaces, this street commences at the Exedra of the Diocletian Thermes; it runs perfectly rectilinear with a width of 24 metres to a certain point, where it makes a right angle and descends to the Piazza Venezia, on which is the celebrated Palazzo Venezia, one of the finest palaces of the early Renaissance at Rome. Here, this monumental road comes to an end. It was commenced before 1870 by Mgr. Xavier de Merode and was fin-



VILLA SCHMIDT.

Near Genoa. F. M. Parodi, Architect.

VILLA SCHMIDT.

Near Genoa.

F. M. Parodi, Architect.

ished under the management of the engineer A. Viviani. From out of it another imposing street opens, the "Via Cavours," still broader than the Via Nazionale; it runs from the railway station (southwestern side) to the square of the Esquilino near the Basilica S. Maria Maggiore. In this street, the architects of Rome, or rather of Italy, for since 1870 Rome has become distinctly a metropolitan city, have erected structures which bear witness to the building activity. I must also call your attention to the Piazza Vittorio Emanuele, the largest among the new squares of modern Rome; it is situated in the district of the Esquilino and is surrounded by monumental buildings with porticoes and a pleasant lawn embellished with fountains, basins and cascades. Fourteen streets open upon this square from different parts of the great city. To illustrate the architecture of moden Rome, I send you a view of the Palazzo Bocconi on the Via del Corso. Thus one of the most important industrial buildings of modern Rome has been erected on that Corso, which was the street of old Rome, in which the life of the city was centered. Situated near the Piazza Colonna, it is the heart of modern as it was of Papal Rome, and every foreigner will remember it because of the Colonna Aureliana or Antonnia. The Palazzo Bocconi was built by the architect G. de Angelis, after the model of those great industrial buildings in Paris, such as the "Bon Marche," and is used as a department store. It has been designed along classical lines. It is only necessary to add that this building is erected on a plan of 25 metres square; its ground floor is intended for the sales, and the two upper floors are intended one for the fitting of garments and the other for residences of the staff. As for its construction, the walls of the perimeter are dressed in brick, covered with plaster, the ornaments being emphasized by gilding; the interior is of iron, half cast, half wrought, covered with a resistant varnish, of good effect; the whole, like the outside, inspired by the style of the Renaissance, the infatuation of Italian architects.

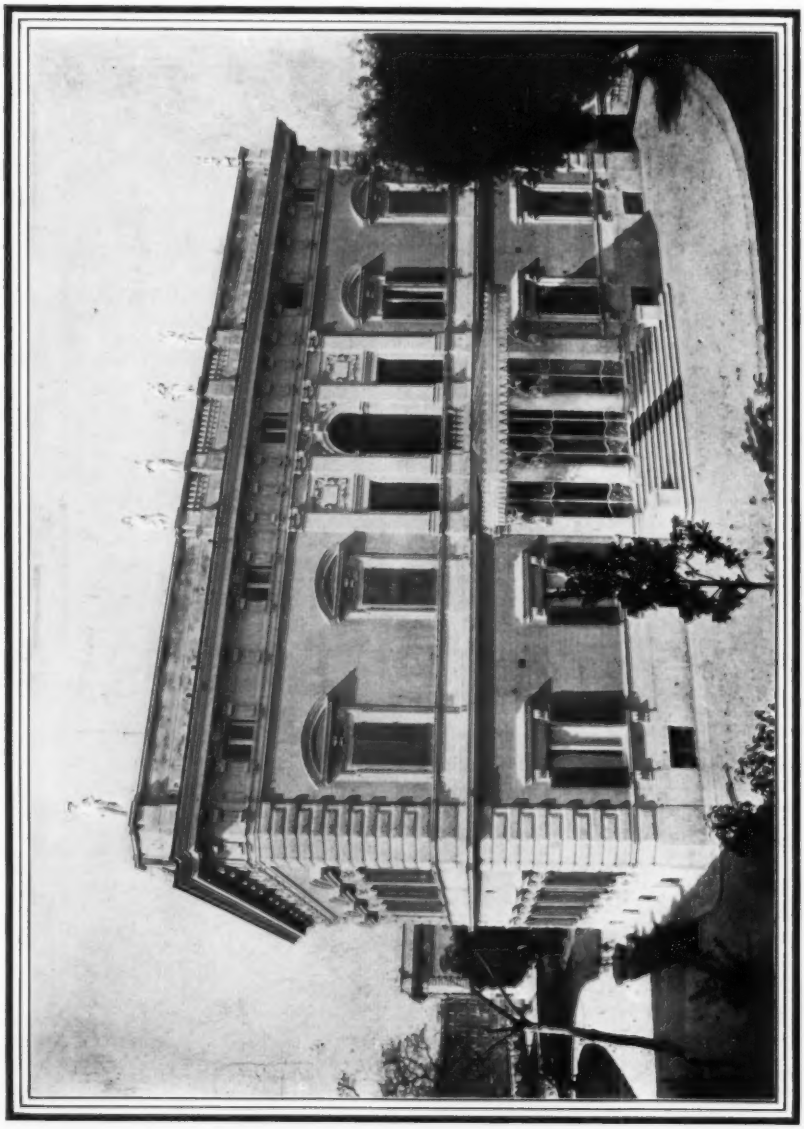
We have another proof for this infatuation in the Villa Buoncompagni, a work of the architect G. Kock; his German name must not surprise you, for, aside from the origin of this architect, his work is absolutely Italian. The architecture of the Villa Buoncompagni is of a more brilliant character than that of the Palazzo Bocconi; but the source is the same.

But at Rome, as at Naples, there is also the Roman and the Pompeiian, and the text changes. Yes, the text changes, but it is as with the music of Pulcinella, the more it changes, the more it is the same. The house and studio of Siemiradzski, designed by A. Azzurri, is, however, a graceful specimen of the adopted Pompeiian or Hellenistic style. To complete the picture we need

PALAZZO BOCCONI.

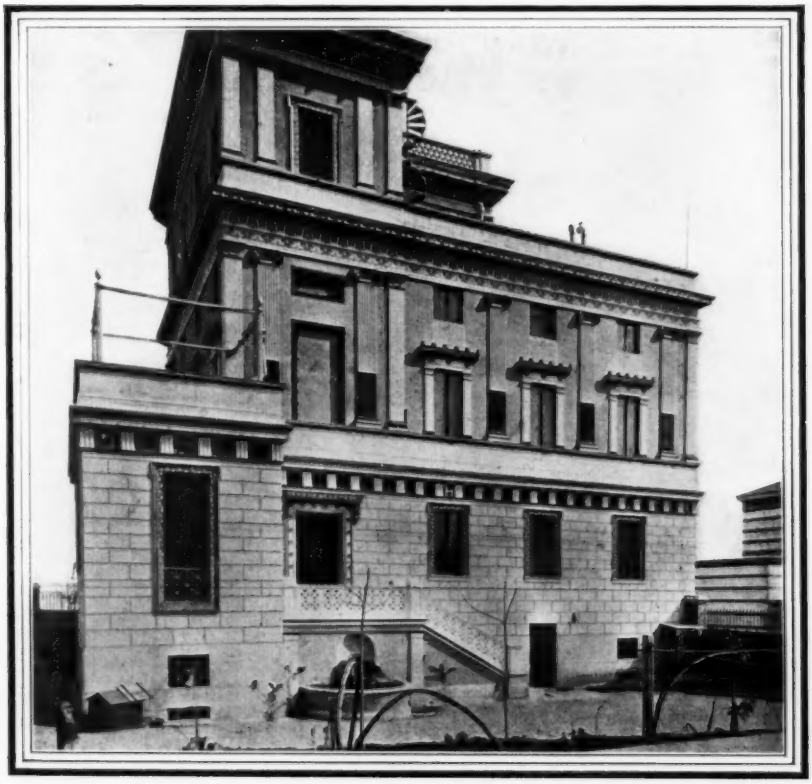
Via del Corso, Rome.

G. de Angelis, Architect.



VILLA BUONCOMPAGNI. G. Koch, Architect.

Rome.



RESIDENCE AND STUDIO IN ROME.
Owner, the Painter, Siemiradzski. A. Azzurri, Architect.

only some bacchanti, such as Siemiradzski, the famous Polish artist, paints with so much enthusiasm. It goes without saying that the brilliant coloring contributes much to the eminently decorative aspect of this house, built by M. Azzurri, one of the oldest architects of Rome; a Roman and a former President of the Academia di San Luca, famous in the annals of Italian art, but at present living on the glory of the past.

Coming to Naples, it should be premised that the most interesting sanitary problem in Italy has been solved in that city—the most interesting because of its proportions. The matter was forced not only on the people of the city, but upon the Italian Government by the fierce outbreak of cholera in 1884. It was shown conclusively that the city could not be made clean and healthy so long as some of its poorer districts were left unchanged. But the undertaking was too great for the resources of the municipality; and the Italian

Parliament vote 100,000,000 francs for Naples, one quarter of which was set aside for sewering the entire city. The sanitary improvements were combined with the erection by a company of some economical dwellings, which were very much needed in that city, where the rents paid by the very poor are much higher than elsewhere in Italy. The modern building activity at Naples did not, however, stop at this point. Two wide avenues had to be opened up in connection with the improvement—the Corso Garibaldi, and the great Corso Re d'Italia—on which were built fine mansions. The latter opens upon a square, the Piazza Depretis, which is or-

CORSO RE D'ITALIA.

Naples.

namented with palaces, designed by the architect P. Onaglia, who, attempted here, as is so often done, to reconcile art with economy.

The North! The North, in Italy, reminds me that I have not yet spoken of Milan, the "Industrial City," which, although respected by epidemics, has nevertheless found it necessary likewise to introduce a new plan, if not for hygienic reasons, yet for reasons of public convenience and embellishment. People who saw our city twenty years ago, and even ten, will find her greatly changed today, especially around the cathedral. Aside from the outlying districts which have also received a number of new buildings, and some

of considerable size, a large and rich road has been opened which leads from the Piazza del Duomo to the Château of the "Porta Giovia," one of the extremities of the city. Looking at these divers palaces, and at these apartment houses, one understands at once the diversity of temper between Lombard and Tuscan, or rather between the architects of Florence and those of Milan. The former, timid, as I have said above, cling to the traditions of the Renaissance; the latter take no orders from tradition, and, without irreverence towards the past, show a spirit of independence for which you would search in vain among the architects of Florence. And

PIAZZA DEPRETIS.

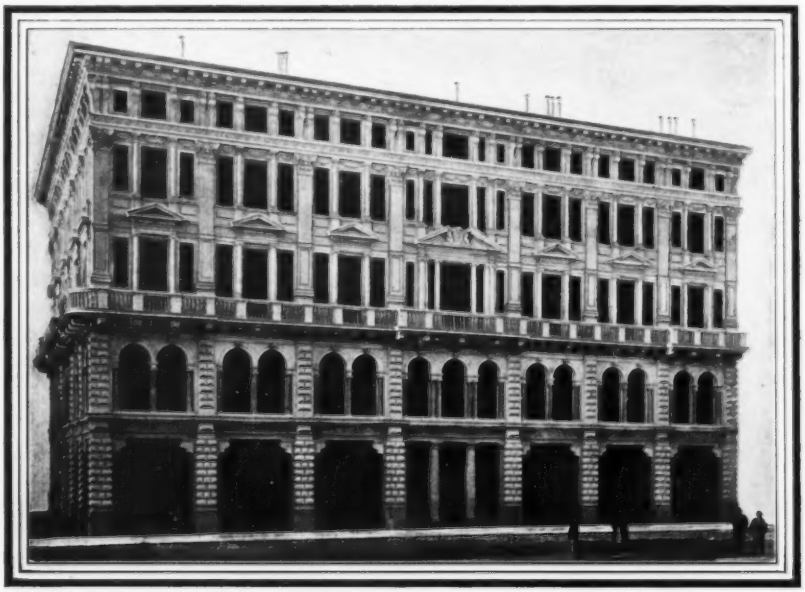
Naples. P. Onaglia, Architect.

pardon me, if I insist on this point, which marks the difference of character between the North and the South and the capital difference between the buildings of Tuscany and those of Lombardy.

In my opinion, the reason is general rather than restricted to the architects. Lombardy wants to rise in all lines of modern activity; it loves effort, new ideas, everything which will lift it out of the routine surrounding it; its architects, prompted by these sentiments, have abandoned the fetish of the past—especially the young men, who, on the contrary, have started upon the conquest of a modern architecture, which, with more or less original form, answers

VILLA FAVALORO.

Palermo. M. Basile, Architect.



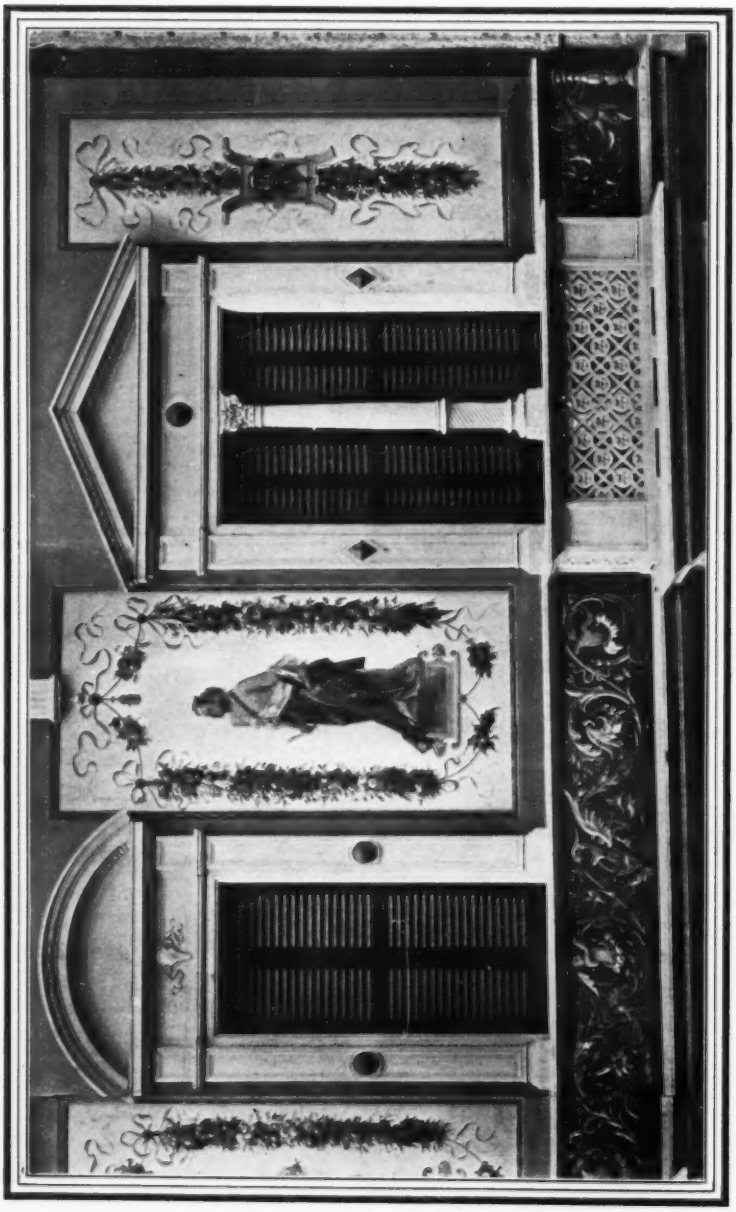
APARTMENT HOUSE IN MILAN.

G. Piravano, Architect.

to new wants. It cannot be said that the buildings of Milan, all of them express this new point of view; but it is the tone of this Milanese architecture, the force and independent tone, which makes a favorable impression. It is here, among the models which I am sending you. One only represents the order of ideas which I wish to point out to you, that of the apartment house erected by the architect E. Zanoni, whereas the house of Bagatti-Valsecchi, whose architects are its owners, shows a deep respect for tradi-

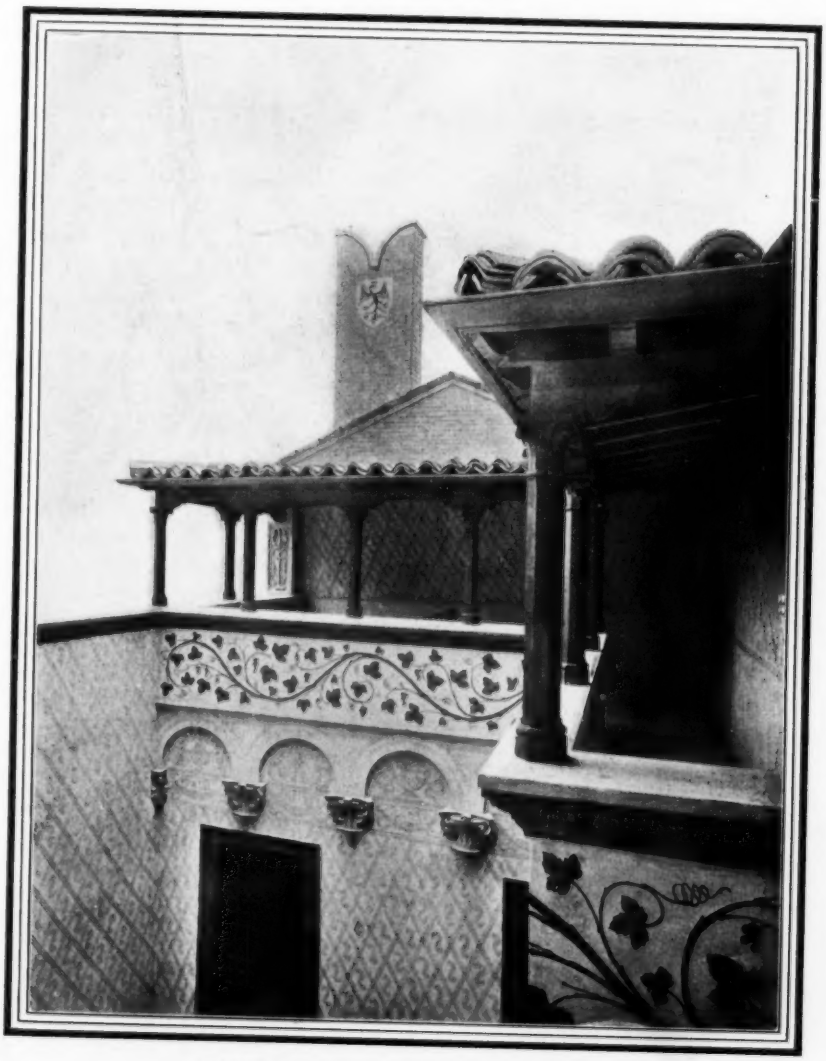
APARTMENT HOUSE IN MILAN.
A. Zanoni, Architect.

tion. But we have here to do with a curious and unique case—men like Bagatti-Valsecchi look at architecture with the eyes of the past only, and, like the outside, all rooms of their house are decorated in the style of the Renaissance, with the most absolute respect for the rules of ancient æsthetics, even there where modern requirement clash with the forms of the past! One part of this house, like that of another house built by the same designers, in the same spirit, is made up of ancient fragments and the other parts, modern, are copied or modelled after existing monuments.



DECORATED FAÇADE.

On an Apartment in Milan. A. Tagliaferri, Architect.



CORNER OF A DWELLING IN MILAN.
Bagatti-Valsecchi, Architect.

We have, therefore, to do with genuine counterpieces intended and realized with a rigidity which is without equal.*

The Renaissance prevails in the other plans to be published by you; but you will notice that in the façade of the architect G. Pirovano, as well as in the detail of the architect A. Tagliaferri, the style has been followed without pedantry, and you will be struck in the façade of Pirovano by the successful manner in which a house of several stories has been composed provided with an enormous number of openings. The American architects, accustomed to solve problems of this kind, sometimes rather complicated, will not take the same view as an Italian architect of the result obtained by Mr. Pirovano; his æsthetical aim was also to give an aristocratic look to an apartment house, a dwelling of the bourgeoisie, but his tone is just a little academic. The façade published by you has received the first prize at the competition, arranged by the municipality of Milan, of façades intended for the "Via Dante," the first one among the modern streets as to beauty and monumental character of its buildings. Even the detail of Mr. Tagliaferri belongs to this same "Via," which bears witness to this activity of Milan, but discloses likewise to those who look behind the scenes, that sometimes building problems are disastrous for those who take them up with illusions colored like the sea of Palermo. I mean to say that the "Via Dante" has found its victims among the contractors, the architects, the capitalists who saw in the exploitation of this "Via" the gold which the leaders of English finance saw in the Transvaal. However that may be, Milan has recently been decorated with a series of sumptuous palaces, on a site where a labyrinth of narrow dark lanes crossed one another. I need not add that these new houses, provided with all modern improvement, elevators, electric light, drinking water, corresponds in their interior to the wealth displayed outside; you can guess so much. Even in Italy, the care for the "home" has been raised to the proper level, and either "stylism" or the free imagination embellishes the apartments with mural decorations, paintings, and furniture. And since Italy has entered into the movement of the New Style and this style has commenced with the rejuvenation of the furniture, it goes without saying that Milan above all, or Turin, the seat of the Exposition of Applied Art of 1902, will receive in future the blessings of the new beauty, of beauty rejuvenated at the bosom of sincerity, the enemy of the imitation of the Old Art.

Alfredo Melani.

*Something similar has just been done at Venice (in 1901) on the Grand Canal. The new Hotel Grûmrald has been erected in the style of the Venetian residences of the XV. century, by making use of antique fragments collected in the stores of the antiquarians; even the bricks have been chosen among old demolished buildings, so that this house, due to the architect, M. Sardi, has not only the lines of the Venetian architecture of the XV. century, but even its coloring and spirit, thanks to the ancient materials gathered and put to fresh use. This is an excess of imitation and copying work which I cannot praise, the more so, since we have to do here with a structure of entirely modern character.

A FRENCH METHOD OF CEMENT CONSTRUCTION.*

II.

A VERY satisfactory example of a building constructed of *ciment armé* has been given us by M. de Baudot, diocesan architect, lecturer at the Musée du Trocadéro and president of the section of architecture of the *Société Nationale* (former *Salon du Champ de Mars*), who has brought to bear upon the employment of *ciment armé* the precision of a mind accustomed to reason out the things pertaining to his art.

In France there are, in art, as in politics, two categories of men —the independents and the followers of the government. The *Ecole des Beaux-Arts* is the seat of official teaching, while M. de Baudot belongs to the independents, and when one sees the results in stone and marble in our public places of the teaching imparted by the "Beaux-Arts," one fells an irresistible impulse to go and see what the independents are doing and hear what they have to say. M. de Baudot lectures at the Trocadéro every Thursday in winter, and he says some very sensible things. He speaks about the architecture of the Middle Ages, and that of the Renaissance. He shows how the problems set by the requirements of religious worship and the economical conditions prevailing at the time, the state of the materials, roads, etc., were admirably solved in the long run by the architects of the Middle Ages. We refer to their system of vaults and independent arches, which constitutes the style of architecture absurdly named Gothic. They arrived at their solution by searching for it in a rigidly logical spirit, and they created the only organic style in architecture that the world has known since the Grecian epoch. Then he shows how that logical spirit which had constituted French architecture, got lost little by little in the sixteenth century; how Italian elements became mingled with the French tradition and disturbed it, and how the habit of reasoning was dropped, with the result that ere long there ceased to be any style, properly speaking. The French neo-classic outstripped its rivals, Italian, German or English, but the true architectural tradition was lost.

M. de Baudot is too intelligent to believe that it is possible to revive an architectural style. He does not care for the neo-classic, and has no liking at all for the neo-Gothic. St. Patrick's Cathedral in New York would fill him with horror, as does the Paris Madeleine. What the ancient Greeks created, or what the French of the Middle Ages created, was the most perfect style for them.

*For first paper see Architectural Record, No. 47, Vol. XII., No. 3.

It is precisely in the concordance of a style with the period and the requirements of every kind to which it has to respond, that lies the primary cause of its greatness. We are not ancient Greeks, nor mediaeval Frenchmen, we are moderns. Have we a style worthy of the name? Assuredly not. We imitate and adopt in a clumsy way. Our neo-Greek is pitiable, our neo-Gothic absurd. There have been heavy imitations of Romanesque, at a useless expense, when the materials which we have at our disposal are quite different from those which hard necessity obliged the eleventh century Frenchmen and Germans to employ.

Can it be supposed that if the builders of the twelfth century had had steel girders at their disposal and could have transported big blocks of stone over long distances at a small cost, they would have wasted their time and money in the construction of rib-vaults? No, practical and economical as they were (for it is only since the seventeenth century that enormous sums have been spent to attain very poor results), they would have sought for, and found, different forms. Furthermore, being artists and men of logic, they would have created the iron style, a thing which we seem to be incapable of doing. Let us then have the sense to borrow from the architects of the Middle Ages, not their forms, nor their processes of construction, nor their materials, nor their decoration, which latter constitutes an integral part of their style and would die, is dying in fact, if it were separated therefrom; but let us borrow their method, their manner of dealing with building problems, and their logical spirit. Then, perhaps, if we do not produce masterpieces of our own (*chefs d'oeuvre* do not spring forth spontaneously), we shall at least prepare the way for those who come after us to do so; we shall clear the ground for them and endow them with a good education, as well as some needful rules of logic.

Such is the thesis developed by M. de Baudot, with an abundance of examples to support it. He studies the past, not as a disinterested observer, but as a man preparing for the future.

M. de Baudot does not confine himself to lecturing to classes; he practices. For the moment, the only works of his which I will mention are the Lycée Lakanal, a brick building in which brick is treated as such, and a small but very interesting church at Rambouillet, which Mr. Russell Sturgis has placed before the readers of the "Record" in his "Recent Examples of Good Architecture."

M. de Baudot was present at the birth of *ciment armé*: he looked at the child, saw it was vigorous but ill-formed, and asked himself whether it could not be so trained as to become, not a freak, but a man. After using *ciment armé* in the restoration in a modern way of some old buildings, the opportunity was afforded him of constructing a church, in Paris. The conditions of the problem,

those primary facts of the case, which so many critics overlook, and yet which are the first considerations that present themselves to architects, were the following. The church was to take the place of one of the earliest Christian monuments of Paris, the old Church of Saint Pierre de Montmartre, which had been found to be too small. The new structure was to be erected, not at the public expense, but by private subscription. Montmartre is a poor district, and the vicar collects very little money. On the top of the hill stands the Church of the Sacred Heart, an immense monument in the erection of which more than thirty million francs has been expended. Yet the vicar of Montmartre had scarcely 300,000 francs wherewith to begin the building of his new church.

M. de Baudot, to whom he addressed himself, saw a fine opportunity for putting into practice theories which he had long ago matured in his mind, theories with regard to building well and yet economically. He asked himself whether *ciment armé* was not the new material which would enable those two conditions to be fulfilled. Nothing interesting had been done so far with this process, and it was worth while to make the attempt at any rate. The ordinary methods of employing *ciment armé*, however, did not appear satisfactory. The material itself is ugly and does not lend itself readily to any decorative effects. Besides, walls built of *ciment armé* cost a good deal of money.

But an engineer, M. Cottancin, has found another and more architectonic means of utilizing *ciment armé*, and his process is worth describing. As is known, *ciment armé* consists essentially of iron wires embedded in concrete or cement, the result being a homogeneous block capable of withstanding considerable pressure and considerable strain. In the Cottancin process, the essential feature of *ciment armé*, viz., iron wires surrounded by cement, is retained; but something is added. Take bricks of the ordinary dimensions with six holes pierced through them. In building your wall, place your bricks flat-wise in the usual way, and end to end. Pass wires through the holes, from top to bottom, and pour in cement to fill the holes. When these wires have been placed, run other wires along the wall, attaching them to the vertical wires. In this way, at a less cost, you form the wires, bricks and cement into a solid block. You have, besides, an immense advantage over the ordinary process, namely, that of building in brick, an economical material which favors architectonic effects and decoration, which can be more or less elaborate, according to the requirements. This is the process of which M. de Baudot availed himself in building the Church of Montmartre.

A careful description will show clearly how the wall of the church is formed, according to the Cottancin process. Two sorts of bricks

were used for it, the larger ones for the outside wall and the smaller, pierced with three holes, for the inner walls. Here and there, the two walls are united by piers, thus forming a well-bonded whole possessing great strength. M. de Baudot has not been afraid to carry to a height of 30 metres a wall having a thickness of only 11 centimeters and 7 centimeters. It should also be stated that the space between the two walls makes an insulator of the first order.

The plan which we reproduce also shows how the floor is made; that is, by a trellis of iron wire covered with cement, supported by compact strips of wire and cement starting from the piers. The result is that the entire structure, walls and floor, forms one solid mass.

The strength of these floors, which are only 5 centimeters thick, can be judged by the following fact. The Church of Montmartre is double. Owing to the slope of the ground, it was deemed advisable to have a lower church, to be used as a catechism room and for the holding of certain services. The ceiling of this lower part of the edifice is the floor of the upper church. It is made in the way we have described. Now on this 5-centimeter floor stood the necessary scaffolding for the erection of the upper church, and in addition to this there was the weight of the walls, the roofing, and the piers themselves, resting upon it. It bore the strain splendidly.

We present to the reader M. de Baudot's actual plans and elevations, for the church itself is still in course of erection, and a lawsuit with the municipality of Paris, who do not permit the use of *brique armée* in the construction of edifices under their supervision, has caused a stoppage of work for the present.

Fig. 1 shows the configuration of the ground. The church is bordered by two narrow streets, steep and bent. At the front, the entrance to the upper church is on a level with the street; at the apsis the lower church is on a level with the ground.

The lesson taught by this edifice lies in the simplicity of the constructive idea and the logical manner in which it has been developed. The piers are built to sustain a given weight and withstand a given strain, and they have the requisite strength, but being in *brique armée*, their dimensions, as can be seen by the various photographs we reproduce, are very small. Certainly, they bear no likeness to the massive stone columns characteristic of the Roman orders. The city committee which is entrusted with the inspection of public buildings uttered cries of terror at the sight of these slender pillars. M. de Baudot answered them with the following sound argument: "When you, official architects, construct a public edifice, if you have need of columns destined to bear heavy weights, you no longer construct them of stone, but of steel. A steel pillar a few centimeters in diameter satisfies you.

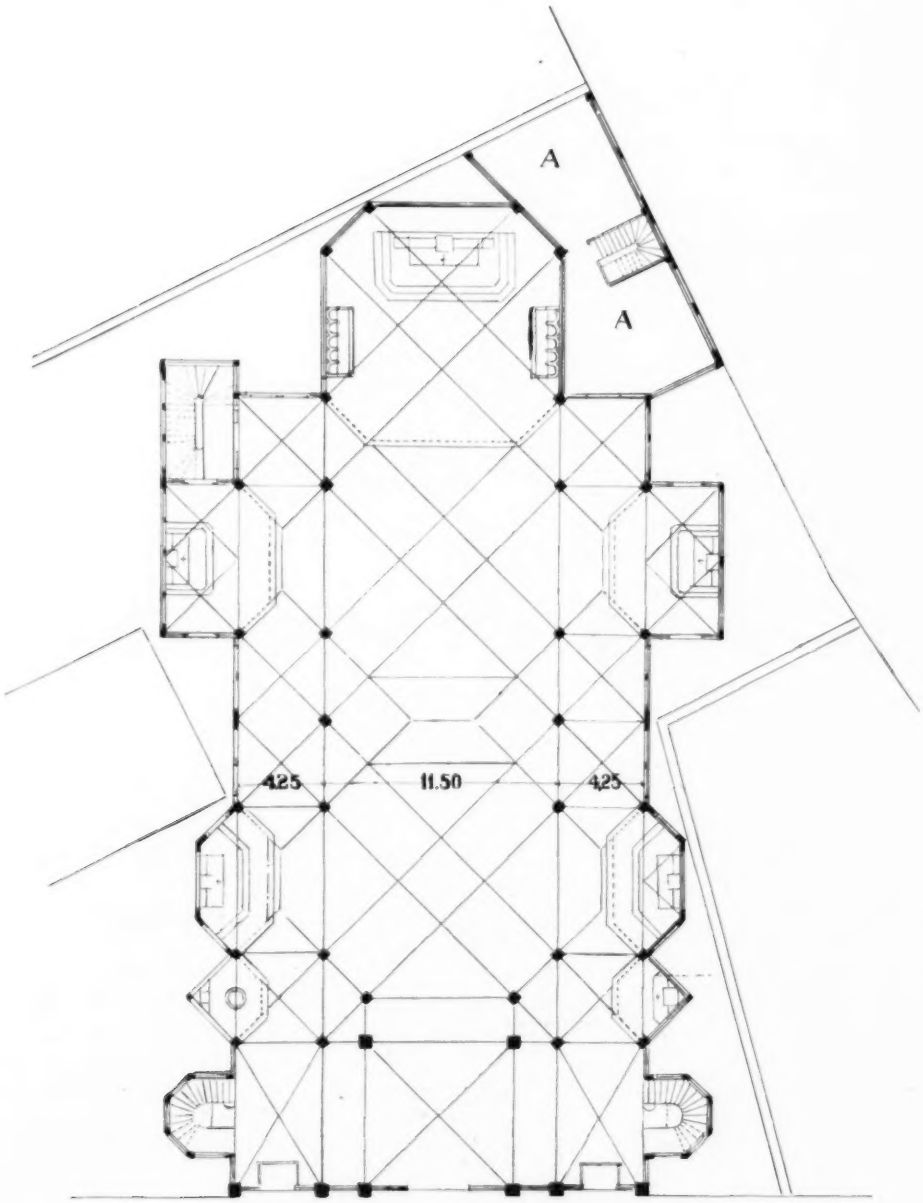


FIG. 1.—PLAN OF THE CHURCH.

St. Jean de Montmartre. M. de Baudot, Architect.

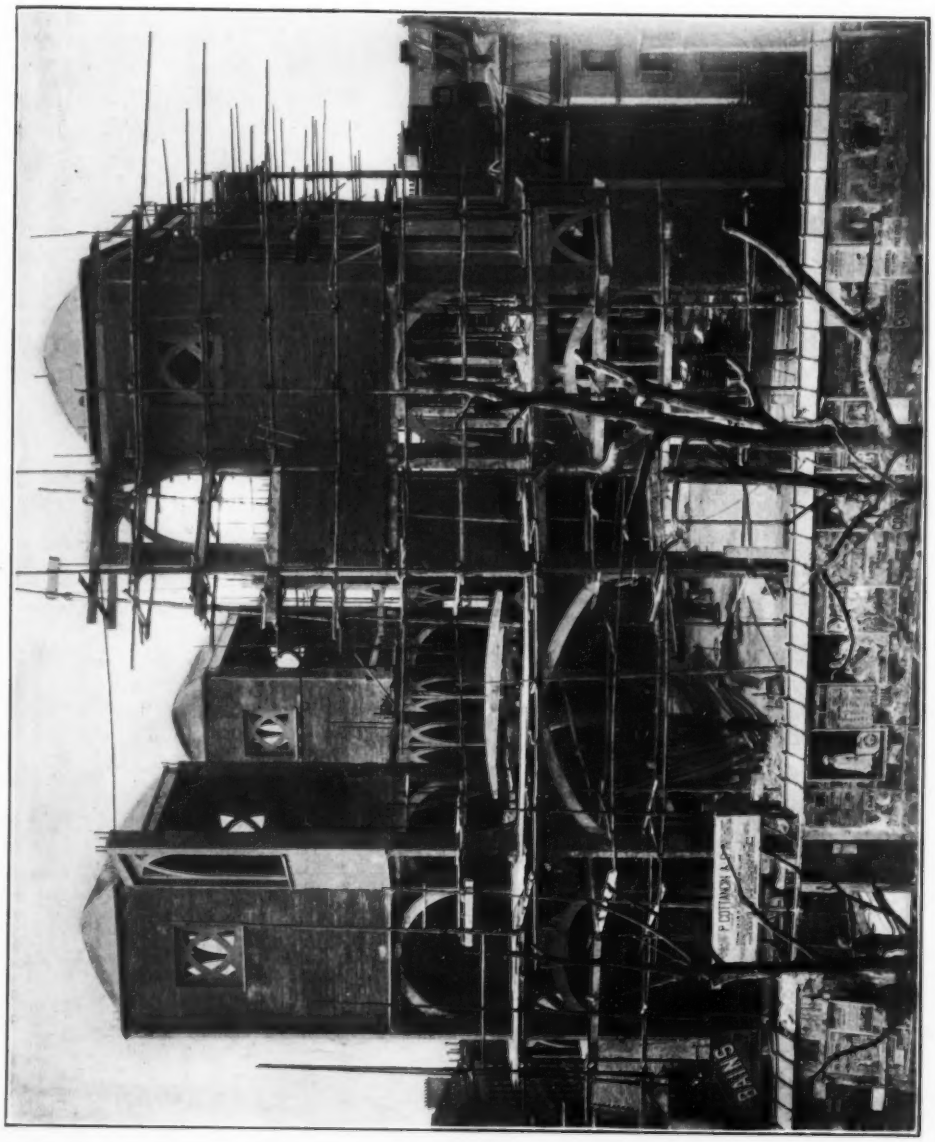


FIG. 2.—ENTRANCE TO THE UPPER CHURCH. M. de Baudot, Architect.
St. Jean de Montmartre, in the Course of Construction.

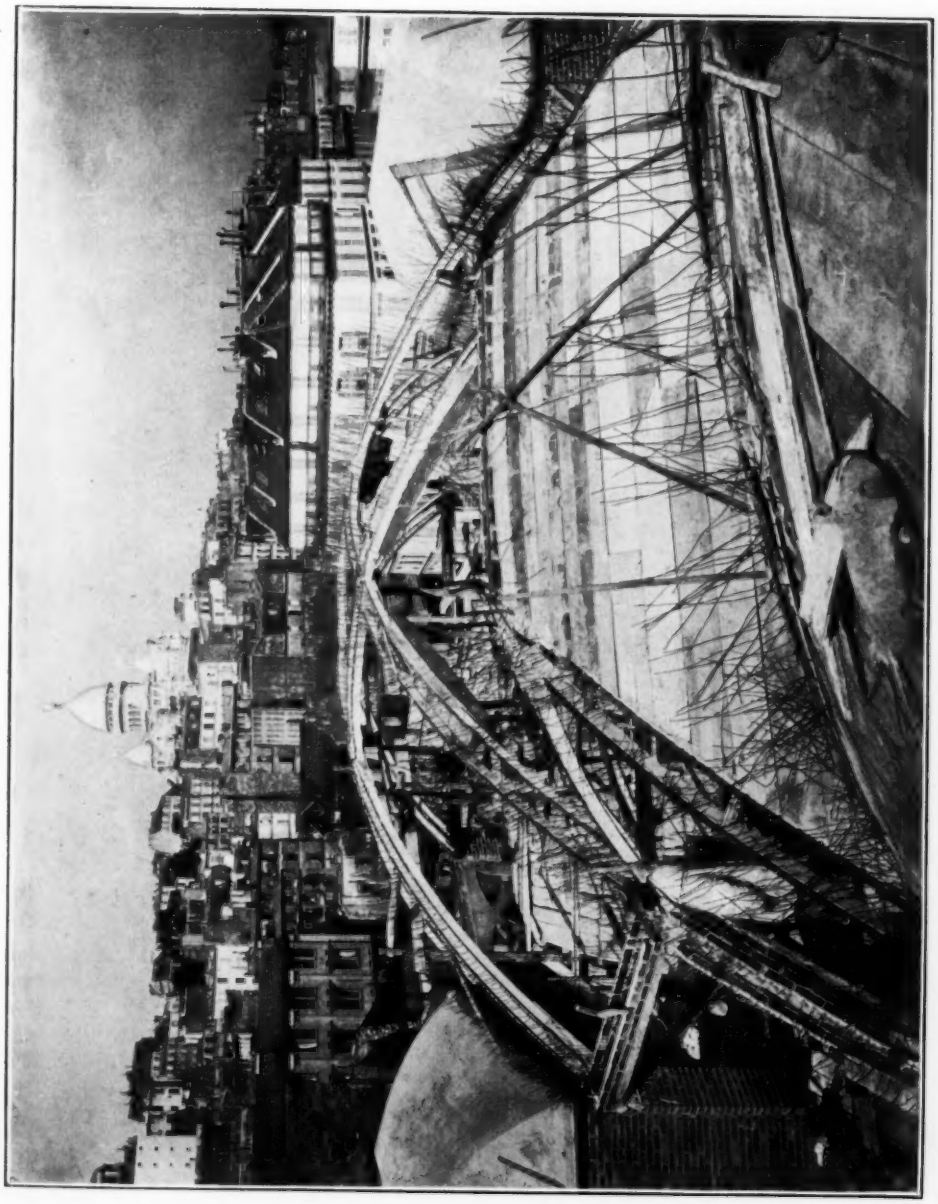


FIG. 3.—ROOF AND VAULT IN COURSE OF CONSTRUCTION. M. de Baudot, Architect.

St. Jean de Montmartre.

Then you bury the steel under a layer of stucco, which you afterwards give the appearance of marble. But it is not the stucco which bears the weight, it is the slender pillar of steel. Now it is against the use of sham materials, against architecture in imitation of stage scenery, that I protest. My pillars alarm you, but they would not have alarmed you if I had surrounded them with useless stone, as was done in the case of the Eglise de la Trinité. Permit me, therefore, to keep them as they are." Thus spoke M. de Baudot.

He showed the same logical spirit in regard to his walls. They rear themselves in bold nakedness. They have no courses with granite rustic-work, no moulding, no cornices, and no platbands. Externally, they appear as they should appear according to their composition, and, thanks to this severely logical treatment, they produce a strong impression. The eye sees with astonishment the apsis wall rising to a height of 30 meters without a single projection, a single flying buttress, a single pier, or in fact any of that mass of materials hitherto considered necessary.

We have given a great many illustrations as the subject is quite new, and architects and builders will take an interest in every detail of an edifice which has been so carefully thought out in all its parts.

Fig. 2 shows the entrance to the upper church in course of construction. One sees distinctly the piers and the network of wires ready to serve for forming and sustaining the roof.

In Fig. 3 we have a fine view of the roofing, showing what an enormous economy is effected by employing this process. Here the cement is "armed" with a wire trellis which forms the covering of the edifice. The vault is supported by compact bands of wire and cement which are attached to the wires belonging to the pillars. The whole fabric is thus made thoroughly strong and firm. The economy effected is remarkable. There is no wooden framework and no covering; a vault on centerings 5 centimeters thick forms at once the ceiling and the roof of the church. The vault is double, the space of a few centimeters between the two vaults being filled with an insulating substance. Truly M. de Baudot has turned his material to good account, and has not used it to reproduce the familiar arrangements which have been necessary owing to the employment of other materials.

In the background of this photograph we can see the immense Church of the Sacred Heart, which was erected by national subscription after the disastrous war of 1870, at a cost which has already reached $6,000,000, but which has not even saved the cause of sound architecture.

The view of one of the sides given in Fig. 4 shows the scheme

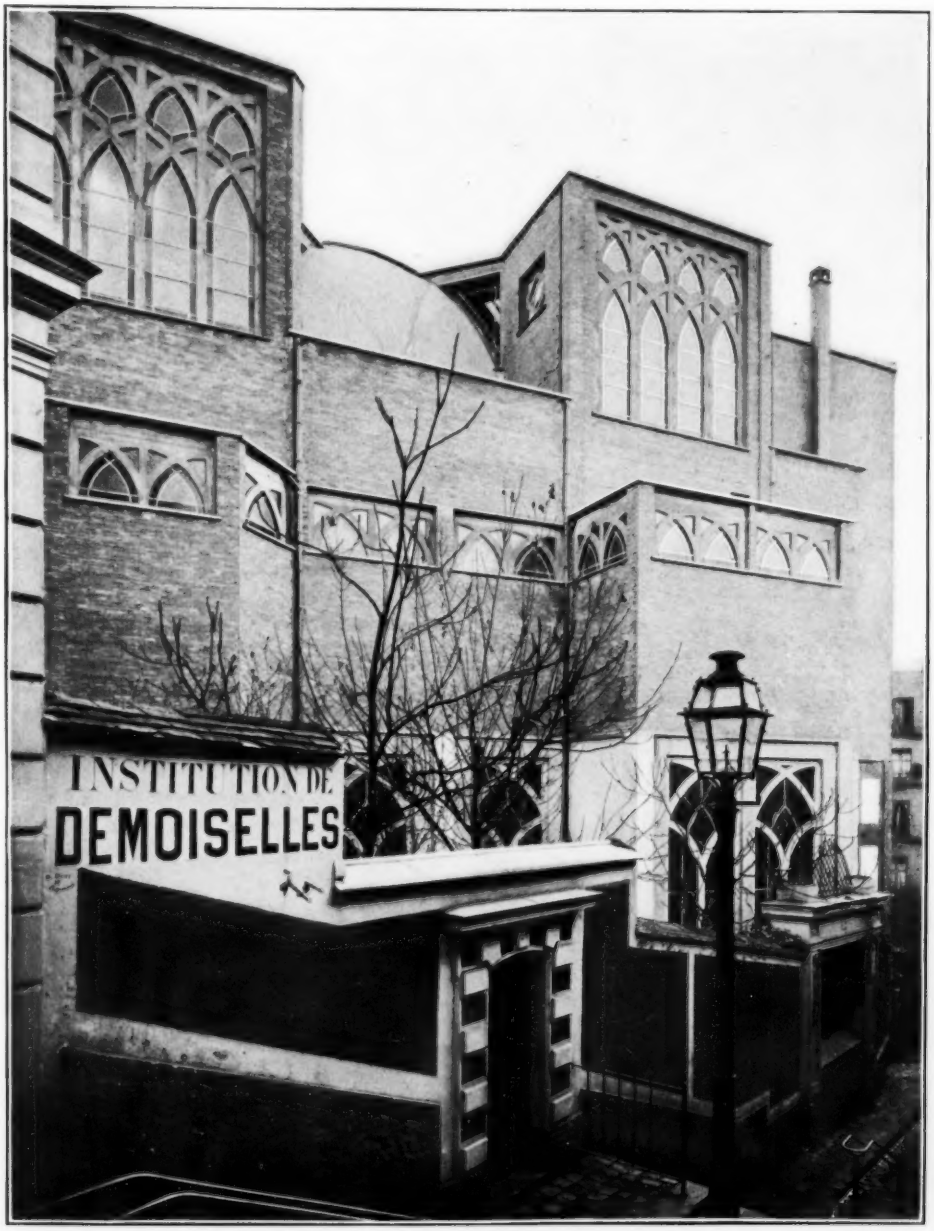


FIG. 4.—ONE OF THE SIDES OF THE CHURCH.
Showing the Scheme of Construction Adopted.
St. Jean de Montmartre. M. de Baudot, Architect.

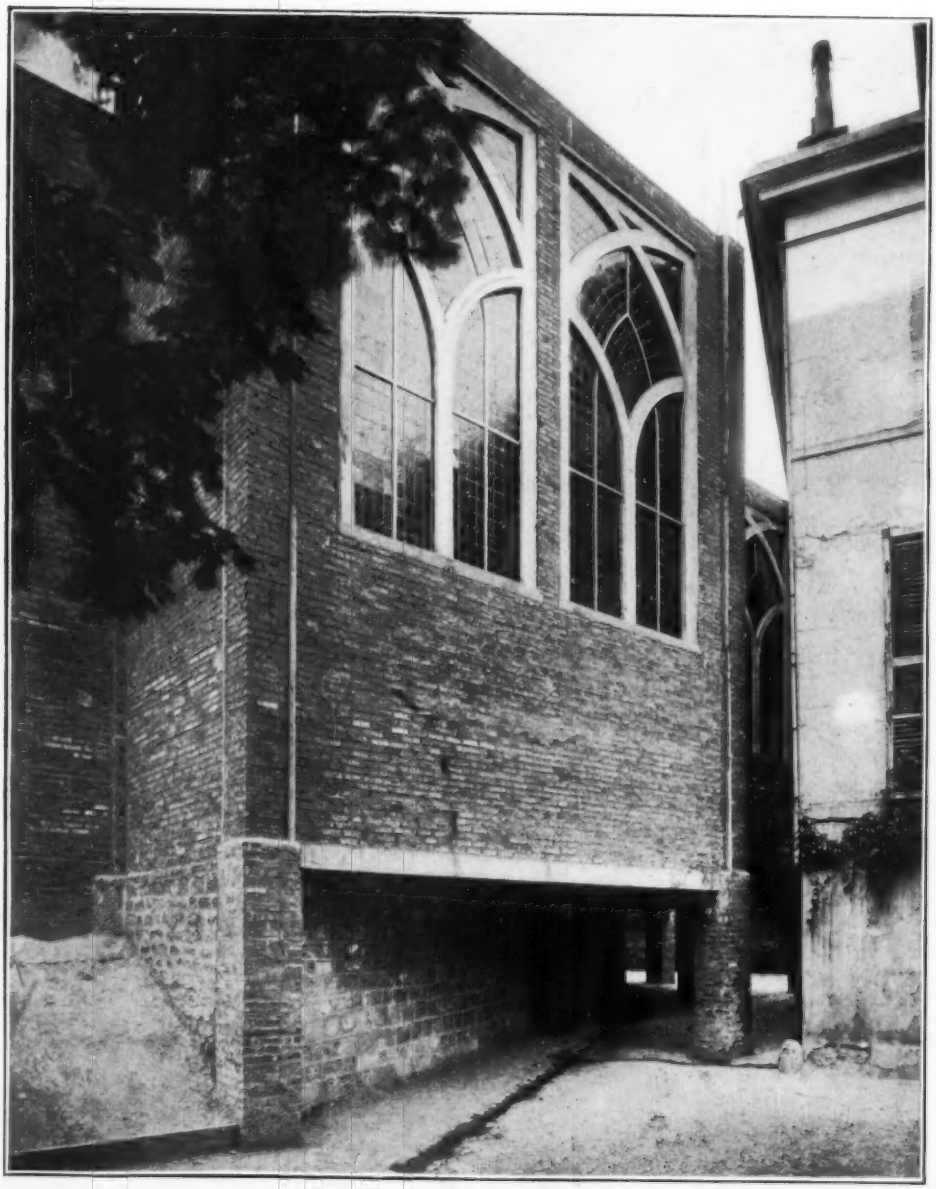


FIG. 5.—DETAIL OF ONE OF THE BAYS.
The Lower Church of St. Jean de Montmartre. M. de Baudot, Architect.

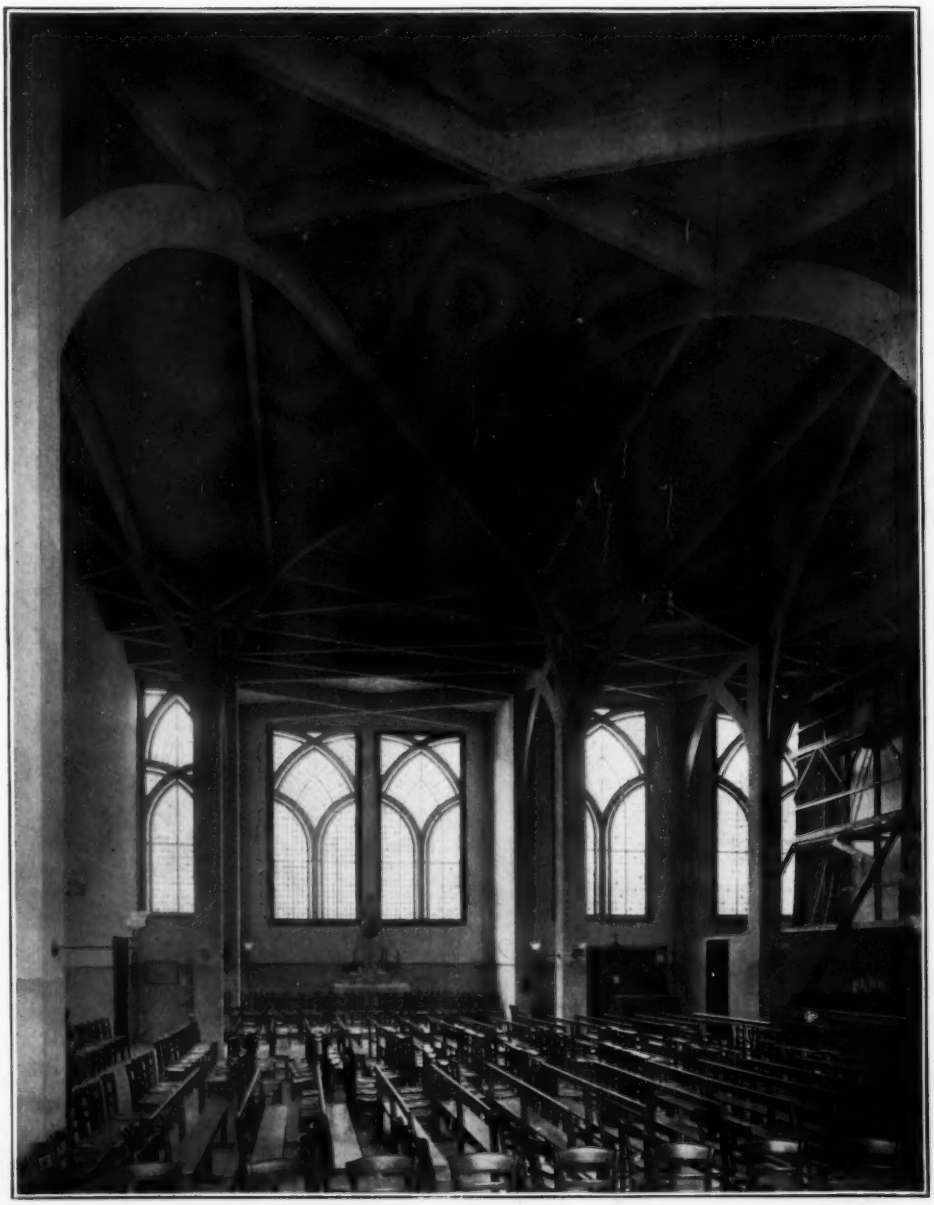


FIG. 6.—INTERIOR OF THE LOWER CHURCH.

St. Jean de Montmartre. M. de Baudot, Architect.

of construction adopted. With *brique armée*, the different parts of the wall being all dependent one upon another, and forming a whole over which the pressures and strains are equally distributed, it becomes possible to have enormous openings. Note, for instance, the large windows of the lower church, which are visible in this photograph. It will be remarked that there is nothing arbitrary about the shape of the mullions, which are also made of *ciment armé* and form, by means of the wires traversing them, an intimate part of the edifice. Above, the aculus in the lateral chapels, together with the different openings at the top, let in a flood of light.

Fig. 5 represents a detail of one of the large bays of the lower church, and shows the bond in a very clear manner. We will mention by the way that the brick employed here is common perforated brick; but there would be nothing to prevent the use of a richer brick. We shall revert to this point in connection with the decoration.

The next view (Fig. 6) is that of the interior of the lower church. The architect, true to his excellent principles, has left the pillars in all their nakedness. For his ceiling, the floor of the upper church, he has drawn a decorative motive from his building materials themselves. Just that, and it is sufficient. These slender pillars, these strips of *ciment armé* and this 5-centimeter floor support the upper church, to the weight of which was added, during the building operations, that of a veritable forest of beams and planks for the scaffolding.

We come at last to the upper church (Figs. 7 and 8), which is still unfinished. But the practised eye sees at once how intelligent is the arrangement. Thanks to the slenderness of the pillars the aisles are spacious and the worshippers can move along them with ease. The vaults, happily and originally conceived, present themselves as what they are, and arches in *ciment armé* have, even at this early stage of their career, taken rank as being effective in a decorative sense. Light enters everywhere; there is not a single dark corner; the openings in the vault have their proper form.

As to the façade, notwithstanding the fact that the architect only had a limited amount of money at his disposal, use has been made of sharp-fire enameled brick, that splendid material which is assuredly destined to play an important part in the architecture of the future. The enameled bricks employed by M. de Baudot, however, are not something put on as a decorative addition, but are built into the edifice and form an integral part thereof, taking the place of ordinary bricks. I lay stress upon this point as it is essential to a thorough comprehension of M. de Baudot's excellent ideas. He does away with the deceptive veneering, the sets of dominos in

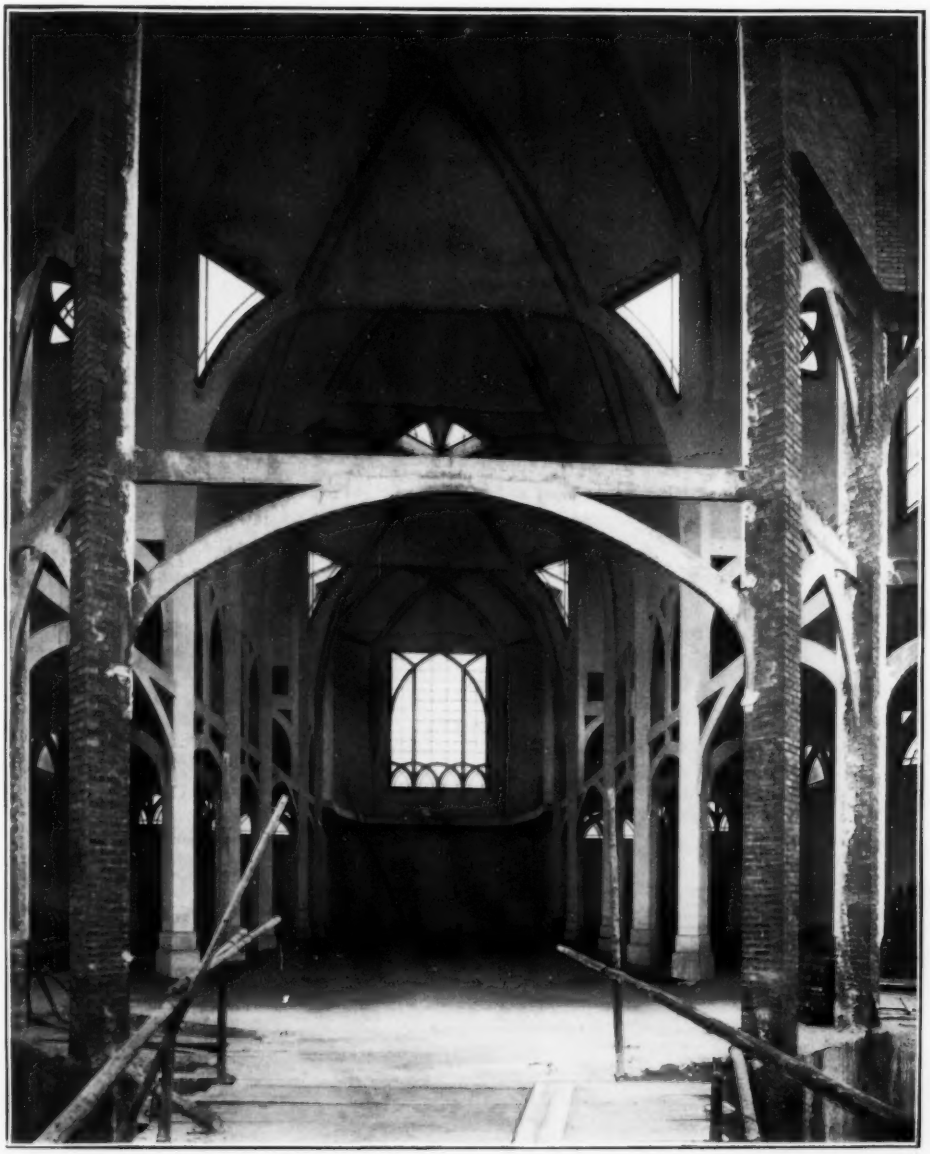


FIG. 7.—INTERIOR OF THE UPPER CHURCH.
St. Jean de Montmartre. M. de Baudot, Architect.

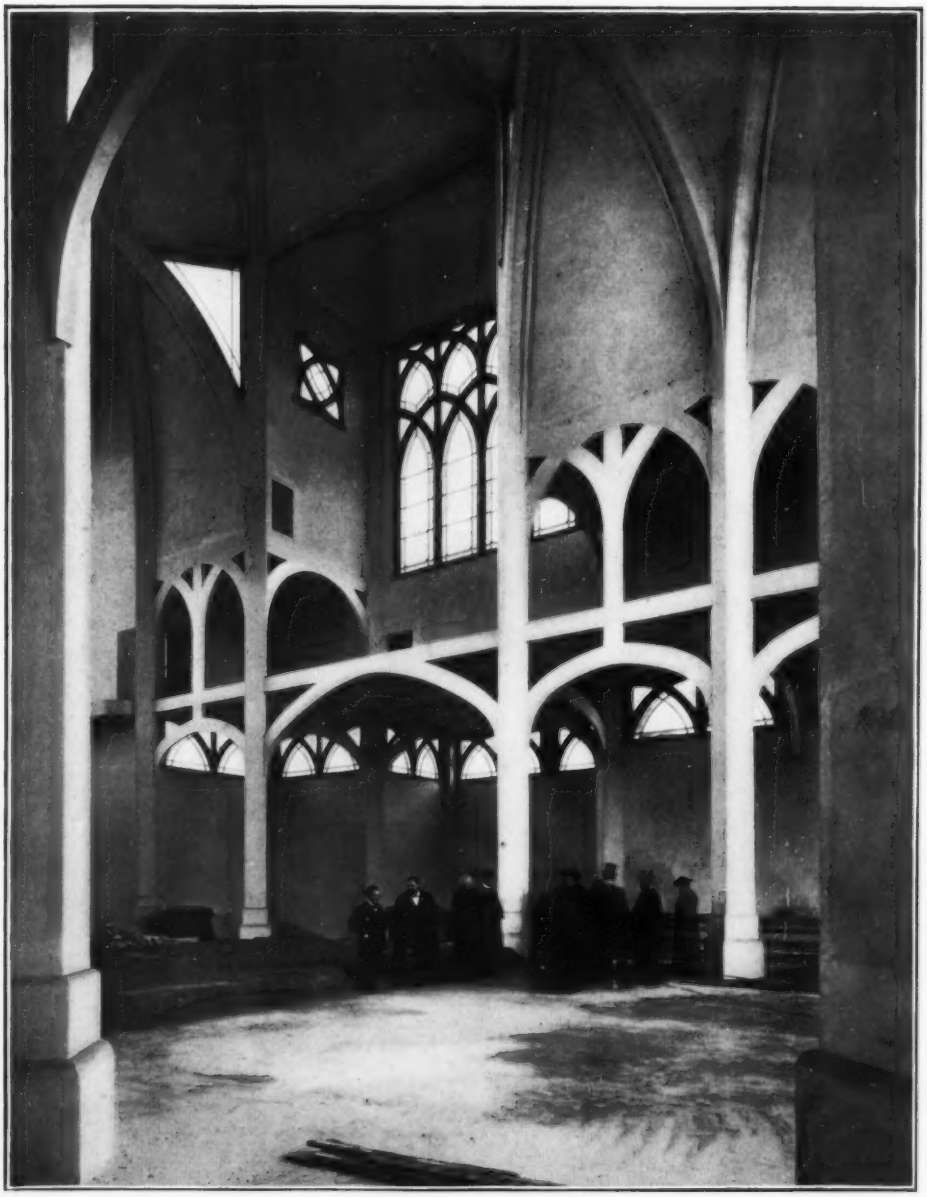


FIG. 8.—INTERIOR OF THE UPPER CHURCH.
St. Jean de Montmartre. M. de Baudot, Architect.

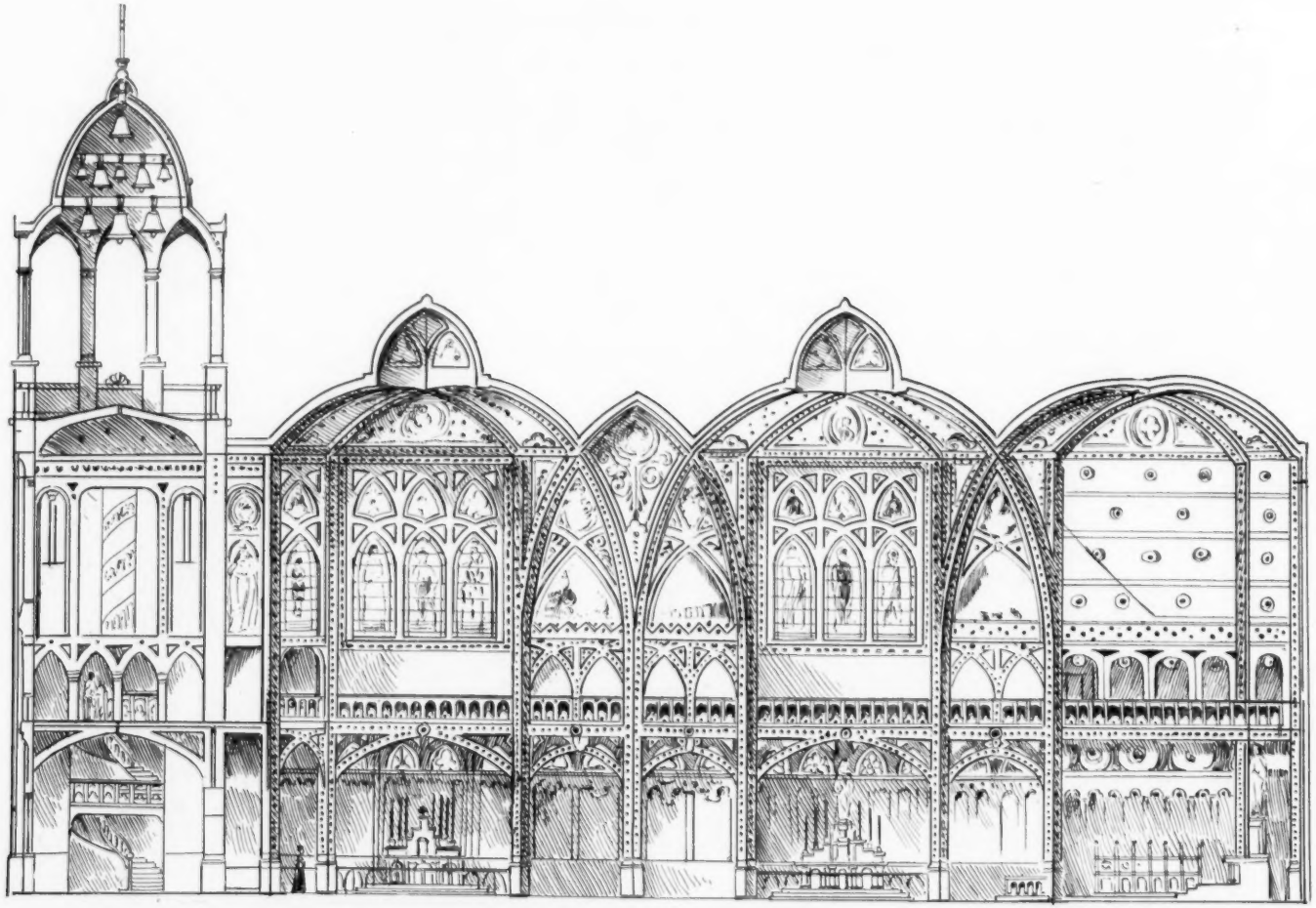


FIG. 9.—LONGITUDINAL SECTION.

The Church of St. Jean de Montmartre.

M. de Baudot, Architect.

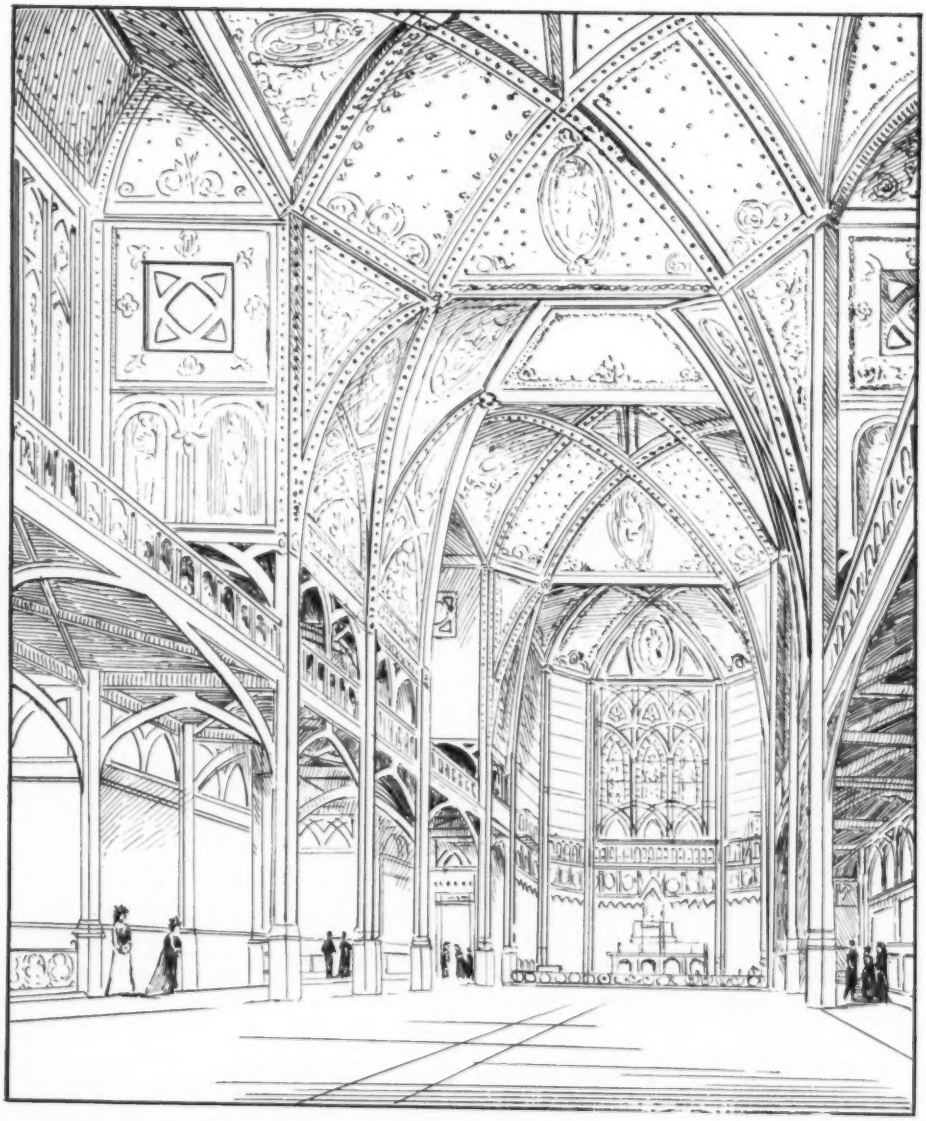


FIG. 10.—PERSPECTIVE VIEW.
The Church of St. Jean de Montmartre. M. de Baudot, Architect.

marble and so forth, a kind of decoration of which the Gothic cathedral of Florence affords the best known and at the same time the most deplorable example.

The views of the interior show how M. de Baudot conceives the decoration of an edifice built of *brique armée*. As can be seen by the longitudinal section (Fig. 9), in the detail and in the prospective view (Fig. 10), the scheme of construction, the necessary shape of the vaults, arches, supports, their crossings, their development, produce of themselves a decorative effect which is manifestly inseparable from the building itself, that is, essential to the structure which they constitute. Such was the case in former days with the Gothic vaults, arches, ribs and columns, and it should always be so.

Finally, it is evident that in a church which is pierced with immense windows, as this one is, these windows provide for the glass-staining art a field of which it stands in need. There is an opportunity here for a revival of one of the most admirable of the arts of the past, an art in which the United States, by reason of the interesting work of Louis Tiffany, has taken in our day the foremost place. For the walls, painted decoration finds scope: archivaults, medallions, lunettes, etc., are calling for a painter of sacred subjects who shall bear witness on the walls of a church to the eternal nature of that faith which, in the thirteenth and fifteenth centuries, inspired the works of such men as Giotto and Fra Angelico.

Such is the Church of Saint Jean of Montmartre. I can picture to myself the smiles of our elegant architects, for whom the Louis XV. and Louis XVI. have no secrets, and who know so well how to disguise their poverty of ideas beneath a profusion of decoration apparently of their own creation, but in reality, filched from collections of examples of the works of their predecessors, I can see their smiles and hear their disdainful remarks as they stand before the walls of this Church of Montmartre. But I hold that, for the man who is capable of studying a plan, of understanding the unfolding of a system of construction, or reflecting upon the architectural use of given materials, of appreciating sequence of ideas and bold, inflexible logic in design, this church in *brique armée*, entirely bare as it may be, and however strange it may appear at first sight, is an excellent lesson in sound, healthy architecture. We do not get such lessons every day, and those who are wise will profit by this one.

Jean Schopfer.

FIG. 24.—A HOTEL AT WEST BADEN, IND.
All the floors are reenforced concrete. The walls are of brick.

REËNFORCED CONCRETE CONSTRUCTION.

American Methods.

WHENEVER any new material or any old material in a new or improved form is offered for use in building, there are certain preliminary questions relating to cost, both comparative and absolute, the peculiarities of action when subject to fire, weather and loads, limitations of use, etc., which must be answered satisfactorily before any detailed investigation is made. These investigations concerning reënforced concrete have been made by a number of engineers and have been answered in the most satisfactory manner, so we can, with propriety, consider them in conjunction with a general description and discussion of the uses and advantages of this material, that is, of concrete in which steel is so embedded as to reënforce the tensile strength of the concrete.

In general it may be said that the reënforcing of concrete by means of steel is neither new nor of American origin. The improvement in recent years has been, first, to secure steel in such forms that it can be easily embedded in the concrete in the location required for effective work, and, second, to make the concrete of materials which are inexpensive both in first cost and in handling, and can be easily brought into intimate contact with the steel.

The factors in these two elements have been the improvement in the brands of American Portland Cement and the decrease in cost thereof. The use of cinders as an aggregate instead of stone and the use of various patented forms of metal, but notably expanded metal. These changes have permitted a competition with better known forms of fireproof construction so keen that the cost of all forms of fireproof construction has materially decreased per square foot of floor area, at the same time that the labor cost has increased.

In all work done in America it is imperative that either the very cheapest form of labor shall be employed or else that intelligent labor shall be so used as to do very much more in units of work performed than is expected of European labor of any grade. In the development of this form of construction American practice differs widely from European practice, and while American applications have not been quite as bold as some of the European applications, they are, in the writer's judgment, far in advance in the line of better engineering and more general in useful application.

As an engineering proposition it is unquestionably better to design so that slight imperfections shall not be fatal to the stability of the structure. For this reason but few American engineers would design bridges along the lines followed by quite a number

of European engineers, who make the thickness at the crown of the arch so slight that even a bucket of imperfect material would endanger the structure.

Speaking broadly, reënforced concrete is concrete with steel strands of small cross-section, so disposed therein as to occupy the position of the extreme fibre on the tension side of the beam or slab, when exposed to external loading. Popularly this may be illustrated in Figures 1 and 2, in which the shaded portion represents the area in tension. Enough steel is embedded in the concrete at the outside of the shaded portion to give the necessary cohesion. Concrete alone possesses very considerable compressive strength,

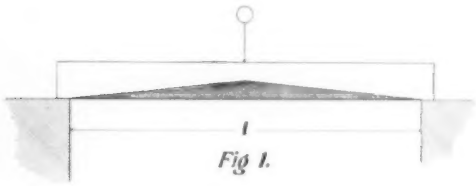


Fig 1.

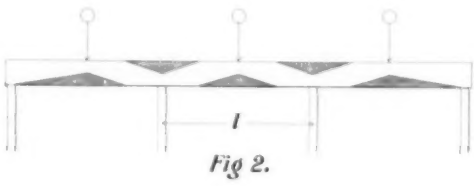


Fig 2.

but when loaded in the manner in which a beam is ordinarily loaded, it fails through breaking on the tension side, and fails with a very slight deflection, the beam of concrete carrying a certain load, but collapsing the instant the load reaches the limit of the carrying capacity of the beam. Concrete beams with steel reënforcement, on

FIG. 4.—BRIDGE, GOLDEN GATE PARK.
Built of reënforced concrete.

the other hand, begin to deflect when the load reaches a certain amount; when the deflection becomes pronounced slight cracks appear in the concrete on the tension side, which gradually widen, the deflection increasing, until finally no more load can be added,

FIG. 5.—FACTORY BUILDING, ERECTED IN 1891.

FIG. 7.—GIRLS' DORMITORY AT PALO ALTO, CAL.
Erected in 90 days of reënforced concrete.

and the beam will gradually sink, tearing the steel apart, if the load be sufficient and the beam be properly proportioned.

In the case of the concrete without steel, the action of the concrete is the same as the action of stone. In the case of the concrete with steel, the action is very similar to that of a steel beam, the ratio of deflection to load being uniform until the elastic limit is passed, when a marked increase in the deflection occurs, after which the ratio of deflection to load is again uniform, until rupture occurs.

FIG. 6.—INTERIOR OF A FACTORY.
The actual floor loads of this building range from 200 to 2,000 lbs. per square foot.

The amount of deflection of a concrete steel beam under a load is slightly less than that of a steel beam of the same depth under a load causing a proportionate fibre stress; this is not absolutely accurate, but is sufficiently so for practical purposes.

The elasticity of properly designed slabs is very great, their performance being quite similar to that of steel sheets. In one of the writer's experiments a slab 20 feet by 23 feet, 6 inches thick, was supported on posts 13 feet apart in one direction and 16 feet apart in the other direction, 4 posts only being used. It was loaded with 66,000 lbs., then six men, whose aggregate weight was over 900

lbs., jumped simultaneously up and down on the concrete, causing a deflection of about $\frac{5}{8}$ of an inch at the instant of impact, but producing no apparent permanent effect on the slab.

Reënforced concrete may be used for walls and columns.

Many of the illustrations show buildings made with concrete walls. The writer is of the opinion, however, that they are not as economical nor as desirable as the usual brick or stone construction. This is not because they cannot be made just as durable, but because of the expense and anxiety incident to securing these results. The form of curtain walls construction shown in Figure 28 illustrates the system employed by the writer in many of his shops erected where there was a treacherous sub-soil and the probability of an unequal settlement. It is an excellent form for

FIG. 8.—BRIDGE ON EVERGREEN ROAD, NEAR PITTSBURGH, PA.
Span 28′ 0″; Width 20′ 0″; Test 12-Ton Roller.

FIG. 9.—CENTERING FOR A BRIDGE.
Situated on Evergreen Road, near Pittsburgh, Pa.

factory construction, because it is a poor conductor of heat, is watertight, durable and inexpensive. Its field of usefulness, however, is practically limited to the cheapest form of building.

The great advantage of the use of reënforced concrete for all floor constructions, arises from the fact that the entire floor may be constructed as one mass, using the principle outlined in Figure 2, which, in accordance with well-known engineering formula, permits of the desired strength being obtained with less thickness than would be necessary in the event of the floor being composed of isolated pieces, non-continuous at the points of support.

In general, the depth required is determined by the deflection requirements, it being usually necessary to limit the deflection to an amount which will prevent plaster from cracking, which is taken at 1-30 of an inch per foot of span. The relative deflections for the two conditions of loading and support shown in Figures 1 and

2, are as 1 to 5. The deflection in the portion marked L in Figure 2 for the same load being 1-5 of the deflection of the part marked L in Figure 1, and the strength of the part marked L in Figure 2 for the same depth of slab and amount of metal being three times the strength of the part marked L in Figure 1 in the center and 1½ times the strength over the points of support.

When it is considered that instead of making isolated beams it is practicable to make a slab in which the strength radiates in all directions from the point of support, the enormous strength shown by tests of floor construction actually made does not appear so very remarkable, but without this understanding of the subject it would appear incredible. The application of this system to a building may be seen in the figures illustrating the store house for the Central Railroad Company of New Jersey, at Elizabethport, Figures 41 and 42, which is built entirely of concrete, the floor slabs being respectively 12 and 6 inches in thickness.

An interesting test may be made, if desired, by procuring a piece of thick cardboard 10 inches square and supported on four spools placed four inches apart; if an ordinary electric push button with bell attached be placed underneath so as to ring when the deflection reaches ¼ of an inch, first apply a load by means of a stick in the center, and then put a load around the edge equal to a total of twice the load which was applied in the center, and apply a load again in the center, it will be found that about four times the amount of the

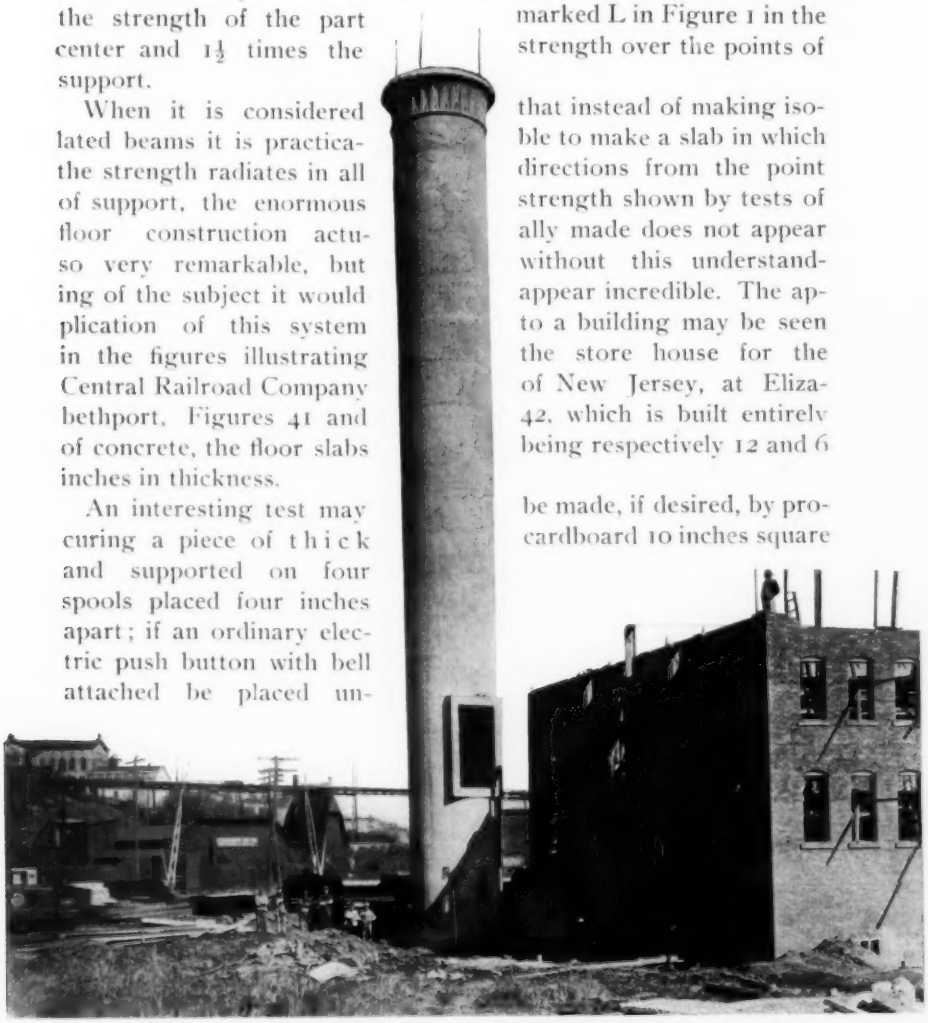


FIG. 10.—CHIMNEY CONSTRUCTED OF REËNFORCED CONCRETE.
No outside scaffolding was used.

FIG. 11.—NASSAU COUNTY COURT HOUSE—FRONT VIEW.

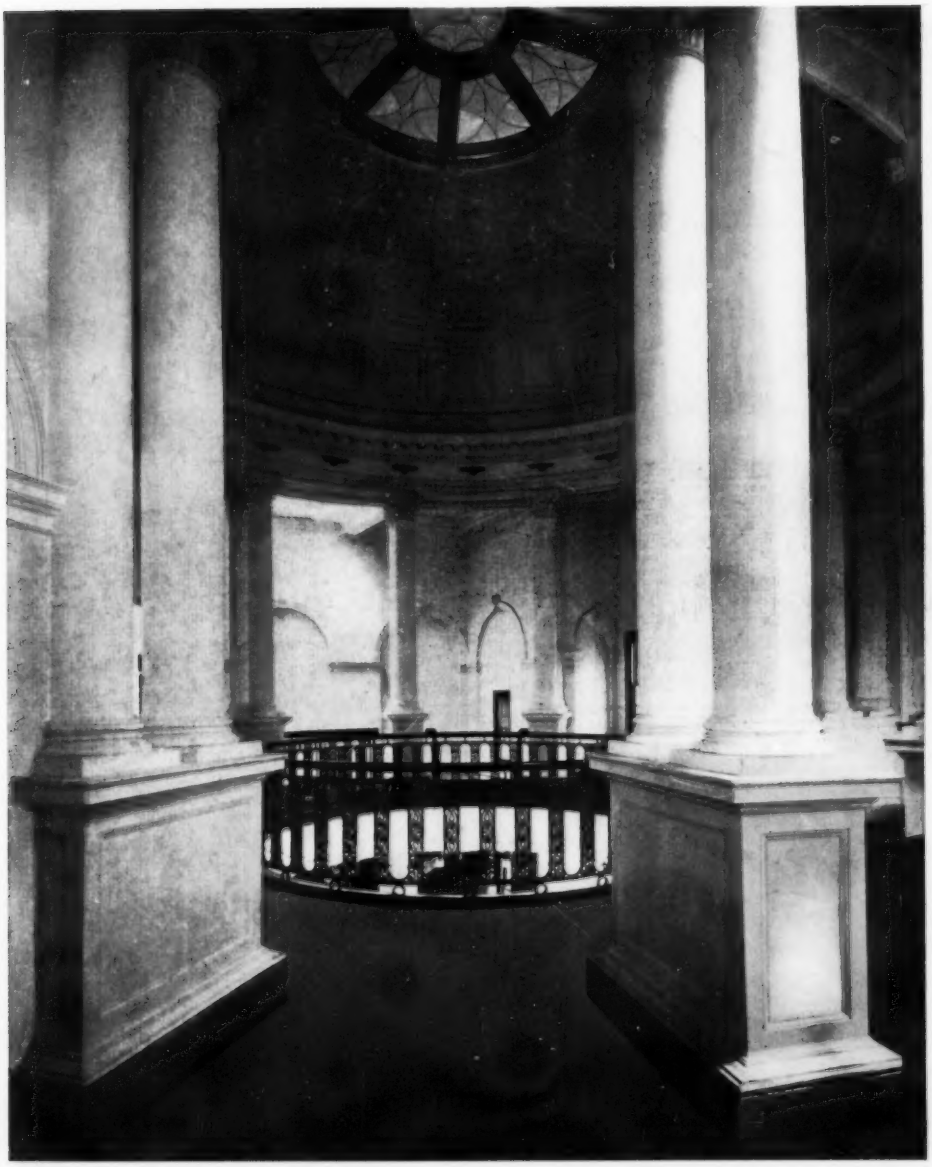


FIG. 12.—INTERIOR OF NASSAU COUNTY COURT HOUSE.

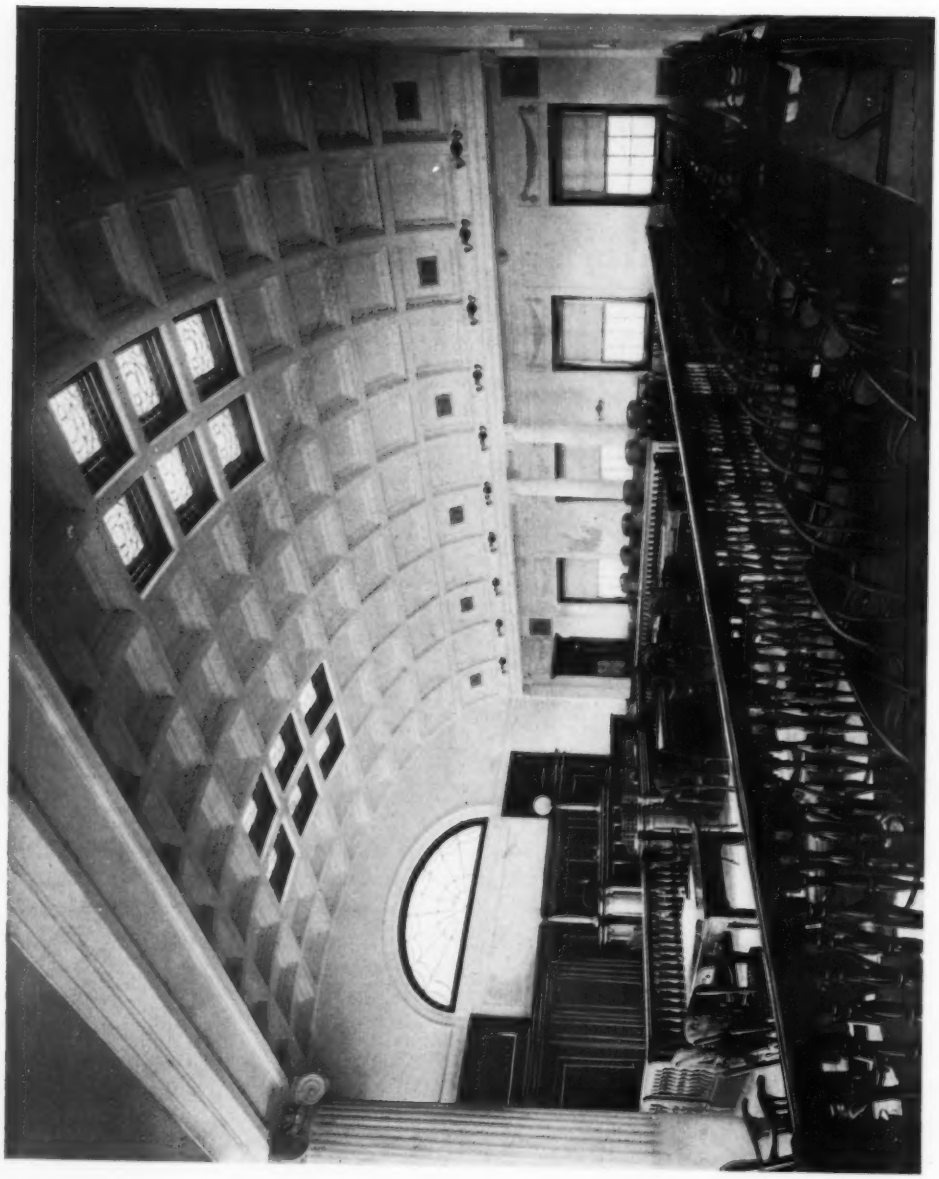


FIG. 13.—INTERIOR OF NASSAU COUNTY COURT HOUSE.
On the elliptical arch shown the ornamental panelling is applied directly to the ribs carrying the load.

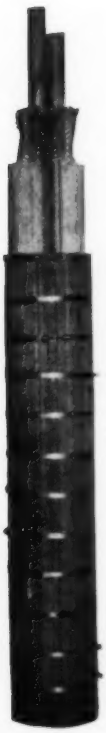


FIG. 14.—CONDUIT COVERING MADE OF REËNFORCED CONCRETE.

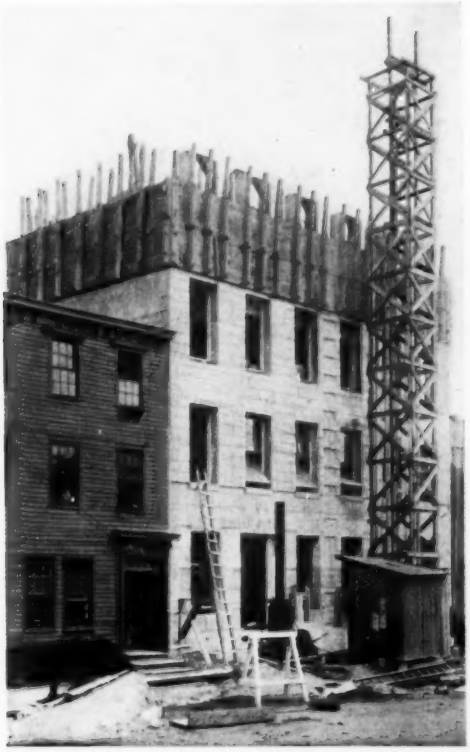


FIG. 15.—THE FORM OF CENTERING USED IN MAKING CONCRETE WALLS.

initial load must be applied to the center before the deflection will again reach a ¼ of an inch; a still larger piece may be employed with other points of support placed 6 inches apart and the load placed at the centers of the flat bays. The writer has made such experiments with a piece of celluloid 1-16 of an inch thick which carried at the beginning 18 lbs., and with 40 lbs. distributed around the edges carried 74 lbs. in the center (Fig. 3).

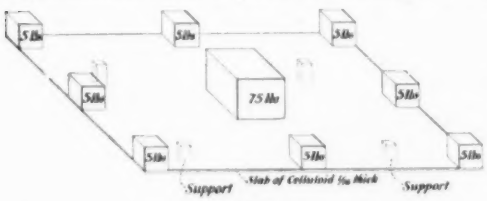


Fig 3.

Floor slabs may be made for ordinary use up to 15 feet span and 6 inches thickness, perfectly flat on both the top and the bottom, the top being surfaced just before setting and the bottom being plastered, if desired, after the centers are removed, adding not more than ⅜ of an inch to the thickness of the slab. For spans greater

than 15 feet or when the load is such as to require a thickness greater than 8 inches, the writer has made a practice of securing the necessary stiffness by means of reënforced concrete girders projecting below the floor slab, as is illustrated in the photographs of the interior of the shops at Dunmore. (Figs. 43 and 44.)

For American conditions it is desirable that the steel should be of such a form that it can be very easily applied, inexpensively purchased, and procured almost anywhere. For this purpose round rods are the best for large sections, though they should not exceed one square inch in area, more than one rod being used where a greater sectional area is necessary. The rods are kept in position by putting a right angle bend in the ends, or by slightly kinking them with a kink shaped like the letter V, and also by the adhesion of the concrete to the steel. The twisted rods of the Ransom system give a very efficient form, as they do not require any form of anchoring;

FIG. 16.—TEST SECTION OF REËNFORCED CONCRETE.

The water conduit, which was 8 ft. 9 ins. wide, 8 ft. 9 ins. high, 5 ins. thick at the top, and 8 ins. thick at the bottom, was loaded with 25 tons of steel rails. The deflection was 7-16 of an inch; 7½ miles constructed.

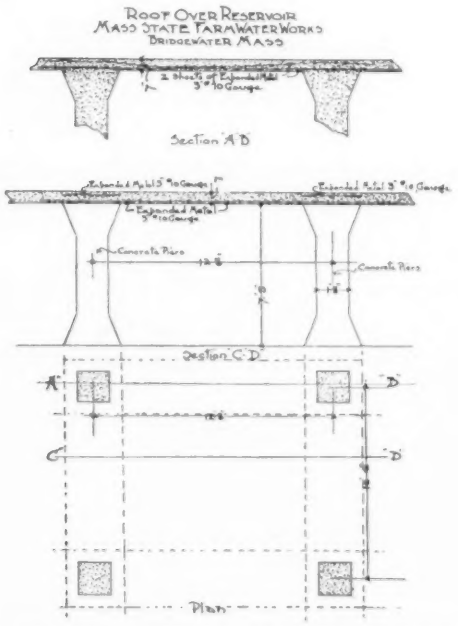


FIG. 17.—SECTION OF RESERVOIR ROOF.

FIG. 18.—THE BEHAVIOR OF UNPROTECTED STEEL IN FIRE.

FIG. 19.—CONSTRUCTION OF A WHEEL PIT. This pit was situated at Walpole, Mass., and was 15 feet in diameter.

the steel in this form should be employed in the top of the slabs, underside of girders, for the formation of lintels and for tieing walls or parts thereof together, and if concrete columns are used, in the exterior of the columns disposed vertically. The writer

FIG. 21.—CONSTRUCTION VIEW OF THE WHEEL PIT.
Showing the flume deck and the centering for the wheel pit.

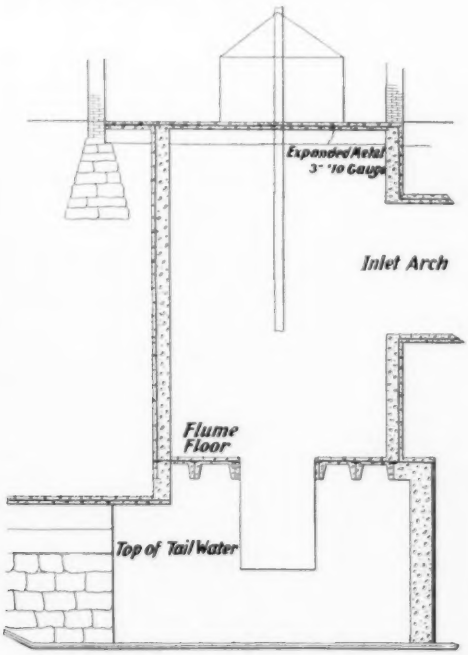


FIG. 20.—GENERAL VIEW OF THE WHEEL PIT.

FIG. 23.—AN AWFUL EXAMPLE.

A building made with terra cotta blocks and structural steel, supposed to be fireproof, and used as a pattern-shop, practically destroyed by fire.

FIG. 22.—FIRE TEST OF CINDER CONCRETE.

The floor shown carried a uniformly distributed load of pig-iron of 1,000 lbs. per foot. When loaded 400 lbs. per square foot, it was subject to fire on the underside, the temperature being between 600 and 1,000 degrees C. for three hours, during which time the deflection increased from 0 to 0.8 inches. The temperature of the I-beams, which were surrounded with cinder concrete during this time, did not rise above 120 degrees C. The strength of the slab was practically unimpaired.

has used steel wire cables in the construction of cistern walls, laying the cables in the concrete composing the walls in a spiral form going round and round the cistern, lapping the ends about 4 feet to secure the necessary tie. Rods may also be advantageously used in footings, as illustrated in Fig. 34. The special form of rolled steel shapes used in some systems of reënforced concrete are, in the writer's judgment, objectionable, since they are much more expensive per pound than the rods and have the disadvantage of requiring too much care in the setting, and a lack of concentration of the area of the steel at the point where it can

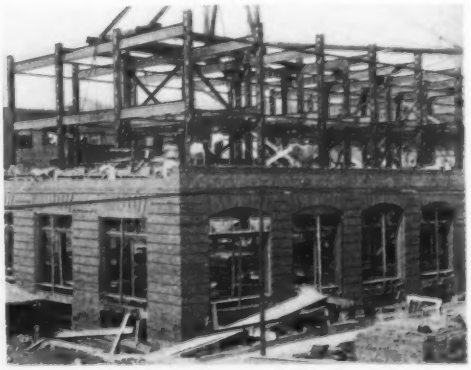


FIG. 26.—THE EFFECT OF CONCRETE CONSTRUCTION ON STEEL FRAMES.

Framing for a steel skeleton building with all the beams and girders in place, showing the reduction in steel effected by this form of construction.

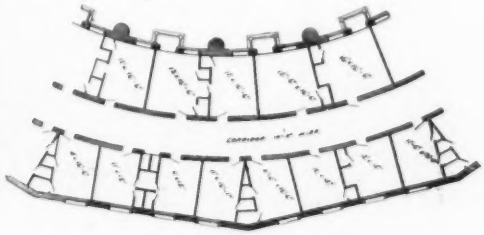


FIG. 25.—FLOOR PLAN OF HOTEL AT WEST BADEN SPRINGS, IND.

All floors of reenforced concrete.

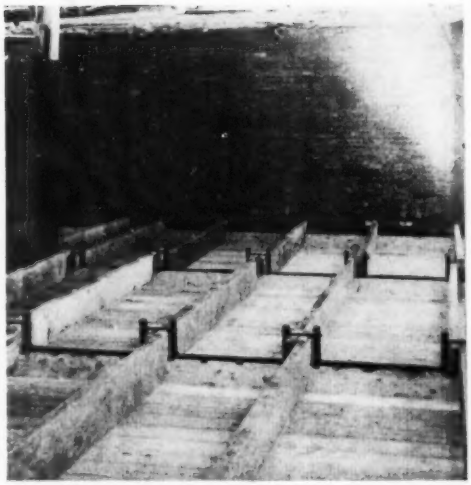


FIG. 27.—CENTERING FOR A STEEL FRAME BUILDING WITH REËNFORCED CONCRETE FLOORS.

FIG. 30.—FLOOR FOR THE SUPPORT OF GRAIN BINS.
These floors were actually loaded to 4,500 lbs. per square foot.

do the most good. This is particularly the case when the steel shapes are nearly as deep as the concrete which is needed to surround them.

There are various forms of steel mesh, of which perhaps the best known is expanded metal, which have been advantageously used. Practical and commercial considerations have led the writer in his practice to the use of expanded metal whenever steel is required in the bottom of a floor slab, and to the use of rods whenever metal is required in the top of a slab. In general it may be said that for steel in the bottom of a slab, No. 4 expanded metal is as heavy as should be employed, but in all cases the concrete must entirely cover the steel.

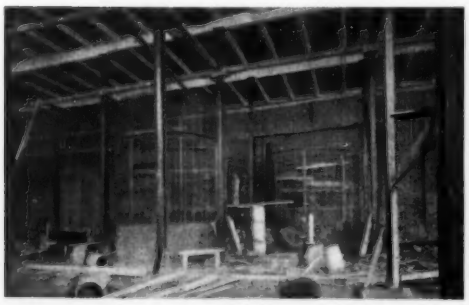


FIG. 29.—TANKS FOR PAPER PULP.

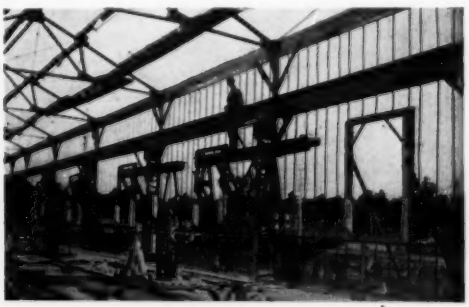


FIG. 28.—FRAMING FOR FACTORY SIDE WALLS.

FIG. 31.—THE FLOOR SHOWN IN FIG. 30 IN PROCESS OF CONSTRUCTION.

On the right it is partially completed. The circular tubes are for the discharge pipes from the bins.

FIG. 32.—UNDERSIDE OF THE COMPLETED FLOOR SUPPORTING THE BINS.

Shown in Fig. 30.

The formula to be employed in the computations of strength have been the subject of investigation both in this country and abroad, and many a beautifully intricate formula has been deduced; unfortunately, the knowledge of the properties of the various kinds of concrete has not reached a point where the constants for use in this formula have been determined with reasonable accuracy, and the writer therefore uses a simple formula of his own, which in conjunction with the large number of experimental results which he has, enables him to properly design the structure. Similar empirical formula are in use by other practical workers.

In all cases the cement used cannot be ground too fine, and should be a high grade Portland cement ground very fine. It

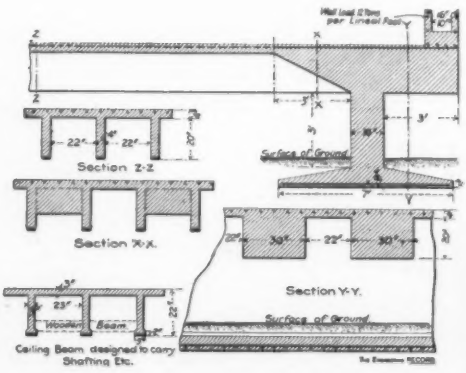


FIG. 33.—CANTILEVER SUPPORT FOR FACTORY WALL ON SOFT GROUND.

A wide spread was required for the footing.

FIG. 34.—CONCRETE WALLS FOR BLACKSMITH SHOP.

This shop belongs to the Jersey Central R. R., and is situated at Elizabeth.

should be so proportioned and burned that the initial set will take place in not less than 15 minutes. A sufficient specification for the cement is that it should be a Portland cement ground so that there will be a residue of not to exceed 5% on a No. 200 seive, that it lose not more than 5% when heated red hot, and weigh 95 lbs. to the bag. The high grade American Portand cements will comply with this specification and will be entirely satisfactory.

Concrete may be made, using any hard angular material such as broken stone, for the aggregate, but of late years it has been found that an excellent concrete unaffected by fire, of good strength, light weight, and small expense can be made by using the cinders from ordinary hard coal furnaces for the aggregate. They do not require any treatment except the breakage of the large lumps with a shovel. The writer has used furnace cinders entirely without screening with most satisfactory results. It must be ad-

FIG. 35.—OIL HOUSE.
Situated at the Elizabethport Works of the C. R. R. of N. J. Tanks holding 70,000 gallons of oil are in the basement.

FIG. 36.—THE POWER HOUSE.
Situated at the Elizabethport Works of the C. R. R. of New Jersey.

mitted that to the ordinary engineer, accustomed to the use of broken stone, the use of cinders appears the height of folly, as the material seems to be absolutely unsuited to give satisfactory results, but several years of experience and of repeated tests have confirmed the writer in his present practice of using cinders in all cases, except where weight was a desirable factor. When cinders are used they should be mixed with sand and cement. To determine the amount the writer fills a receptacle with cinders well shaken down, then fills up the receptacle with water, using the volume of water increased by 10% to determine the volume of sand required, and to similarly fill a receptacle with dry sand well shaken down, and to use the amount of water required to fill the voids, increased by 15% as the amount of cement required. To mix a batch of concrete a dry board platform is required, on which a measure is made by nailing four boards together in the form of the sides of a box, which will hold the amount of cinders, which

FIG. 37.—INTERIOR VIEW OF THE ENGINE ROOM.

Situated at the Elizabethport works of the Jersey Central R. R. Floor, a flat slab of reenforced concrete 12 inches thick. Roof of reenforced concrete 6 inches thick. No structural metal used, except small expanded metal rods 1 inch diameter, and the cast-iron columns shown.

FIG. 40.—POWER HOUSE.

Situated at the Elizabethport works of the C. R. R. of N. J. It stands on piers without any cellar. Flat floors and ceilings. Load about 400 lbs. per sq. ft. First floor 12 inches thick. Second floor and roof 6 inches thick. Expanded metal in the slabs.

should be mixed with one barrel of cement, then the cinders are filled in this box and leveled off. On top of this the required amount of sand is spread, and then the cement spread on top of the sand; the box is then moved. If a mixer is used, the workmen shovel from the bottom into the mixer, taking a small portion of cinders, sand and cement in each shovelful; if a mixer is not used, they shovel from the bottom into a new location, turning the cement through as it is turned over. The mass is then shoveled into a mound, raked down, water added and turned over into another mound, from which it is shoveled into wheel-barrows.

FIG. 38. INTERIOR VIEW OF ENGINE ROOM OF C. R. R. WORKS AT ELIZABETHPORT.

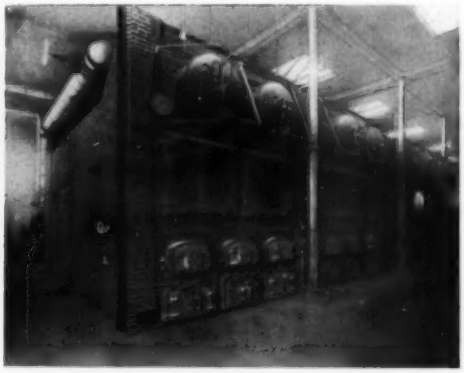


FIG. 39.—INTERIOR OF THE BOILER ROOM.

Situated at the Elizabethport works of C. R. R. of N. J.

FIG. 41.—INTERIOR VIEW OF THE POWER HOUSE SHOWN IN FIG. 40.

Enough water should be added to make the concrete decidedly mushy; this will depend on the dryness of the sand and cinders and to a certain extent on the season of the year, more water being required in summer than in winter. The concrete when deposited should be puddled in place and should be soft enough to permit a man sinking to his ankle when stepping on a fresh bed of it. If the mixing is done in winter time, injurious effects by freezing may be avoided by the use of one quart of rock salt to each 20 to 30 gallons of water. If the concrete is put in place in summer time it should be prevented from drying by sprinkling as often as may be necessary.

Stone concrete may be made by using any broken stone or gravel, taking care that the particles are in all cases of random

FIG. 42.—GENERAL VIEW OF THE BIG PLANT.
These shops were built for the Wyoming division of the Erie R. R. All of concrete except the roof of the high building.

sizes, ranging from ¼ of an inch up to 1½ inch, the proportions of sand and cement to be determined in the same way as that already described for the cinders. Stone concrete should be mixed in the same way as the cinder concrete, but should be turned over once or twice more. It should be mixed a little less wet than the cinders and will require a little ramming.

In regard to the use of concrete mixing machines, there are special

cases where they can be used to good advantage. Each case must, however, be considered on its own merits. A good concrete mixing gang ought to use 1⅓ bags of cement for each hour's labor put in by the men, including therein the time of the shovelers, unloading gang, waterman and gang boss.

Forms must be employed for holding the concrete; these forms for ordinary factory construction may be rough hemlock, 2 inches thick, and can be used over and over again without cutting. Otherwise ⅞-inch boards, mill dressed on one side, 2 inches by 4 inches studding placed 2 feet apart on centers, may be used. For a better grade of work 1¼-inch short leaf yellow pine, mill dressed and ship

FIG. 43.—INTERIOR OF CAR REPAIR SHOP. Part of the plant of the Wyoming Division of the Erie Road.

FIG. 44.—CONCRETE RAILWAY STATION. Situated at Bloomingburgh, N. Y., Ontario & Western R. R.

lapped, should be employed. Wherever forms are to be used great care should be taken to frame them solidly, but only of such size as can be conveniently handled by not more than six men. On walls special forms, as shown in Fig. 15, may be employed. It must be borne in mind that in all cases the soft wood swells somewhat, and forms therefore in the nature of boxes must be made with the sides inclining towards each other so as to be easily withdrawn; where a smooth surface is desired the forms should be painted with a solution of soft soap applied just before the concrete is deposited. The writer has tried a number of different kinds of building paper to obtain a smooth surface, but without success. The construction photographs illustrate a number of different methods of building the forms.

The fireproof qualities of Portland cement concrete are very good; this is particularly true of cinder concrete, which is a very poor conductor of heat. (See Fig. 22.) The concrete is not changed in character by fire, and will not crack or shell off. The strength of the reënforced construction is but very slightly effected

by the heat. No better form of fireproofing is known to the writer than a cinder concrete held in place by steel.

When the construction is properly made there is practically no deterioration, the concrete absolutely preserving the metal from rusting, as a long course of observation proves.

The technical journals have published many tests of reënforced concrete showing the phenomenal carrying capacity heretofore mentioned. A detailed review of these tests would hardly be appropriate in an article of this character. The writer has also made a

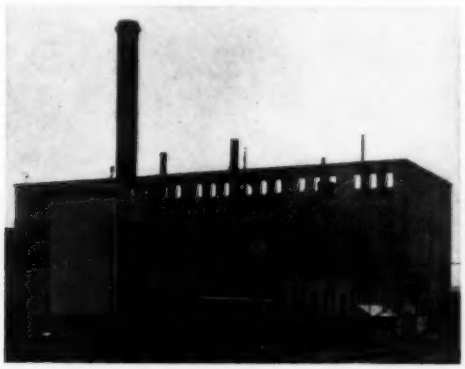


FIG. 45.—EXTERIOR OF PACIFIC COAST BORAX FACTORY, AT BAYONNE, N. J.

Woodwork burned up. Motors and panel boards melted down in many cases. Heavy tanks dropped on floors. Structural part injured about 1%.

great many tests indicating the same result; in one case a load of 140,000 lbs. was carried on four square feet applied in the center of a reënforced arch of 5 feet span without injury.

The best results in the use of reënforced concrete are always to be looked for when the material is used to resist the application of loads producing cross bending in the piece. There are some few systems in which the resulting construction is of arch form; in all of these the writer considers that the material has been improperly applied since tie rods are necessary to take up the thrust of the arch. These systems are further objectionable by reason of the fact that the ceilings in buildings should always be flat, requiring special treatment and adding load to no good purpose.

There are systems in use in which metal does not truly reënforce the concrete, but is simply used as a convenient and inexpensive form of centering. In some of the foreign systems the practice has been adopted of moulding the girders in advance of the floor construction, thereby introducing joints which are objectionable, since advantage is not taken of the continuity of which mention has al-

ready been made. Another objection to some American systems and to some of the foreign systems lies in the peculiar form of the rods, which are so shaped as to make it impossible for the metal all to act equally in tension, the fundamental principle being that the sectional area of the rods as compared with the area of the concrete should be such that the rod is not subject in itself to cross bending. Many of the foreign systems also require excessive labor in placing the rods, which is commercially impossible in this country. As a consequence of these peculiarities none of the foreign systems are regarded with favor by American engineers. The field for the use of reënforced concrete is practically unlimited, the illustrations showing in general what may be done. The only limitation is in making a proper provision for expansion and contraction, the manifestation of which is sometimes rather erratic. So long as the

FIG. 46.—INTERIOR VIEW OF FIG. 45.
The openings were built in for manufacturing purposes.

length of a wall does not exceed 100 feet expansion may be neglected, beyond this length expansion joints must be provided.

Partitions may be made using light steel wire mesh and light steel rods or light steel shapes to support the wire, plastering with Portland cement and lime mixed as a mortar or using moulds, light steel rods and Portland cement and sand, moulding the partition as a continuous structure, the rods being used as a binder around door openings and the like.

Finally, the commercial value of any system is by no means a fixed quantity since it must always depend on the comparative cost of its ingredients as compared with the value of other competing materials so that a construction which may be to-day the most economical may be less economical next week.

Geo. Hill, Mem. Am. Soc. C. E.

THE NEW YORK STOCK EXCHANGE.
Architect, George B. Post. Sculptor, J. Q. A. Ward, assisted by Paul W. Bartlett.

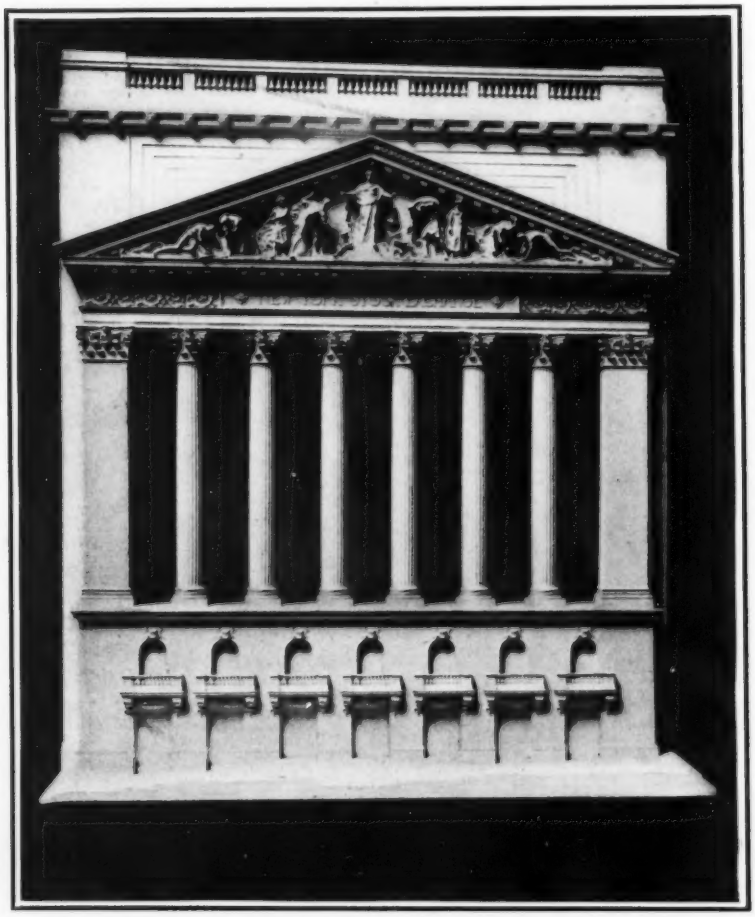
THE NEW STOCK EXCHANGE.*

DECIDEDLY the most important and perhaps the most interesting piece of architecture now under construction in New York is the new Stock Exchange, occupying the site of the old one and the spacious addition secured by the demolition of the Western Union Telegraph Building adjoining. The frontage, of something like 140 feet, thus secured would make any building noticeable and noteworthy that occupied it. But the effect of the apparent magnitude is greatly enhanced by the largeness and simplicity of the architectural treatment, the huge scale and the unmistakably monumental character.

Already the front is assured of a great success, upon which the architect and his clients are greatly to be congratulated. And it is to be noted that this success has been gained by the simplest and most direct and straightforward expression of the facts of the case, the satisfaction of the actual requirements. We can rely upon getting something like this from its architect. It is a distinction of Mr. Post's that he commonly manages to reduce his architectural problem to its simplest expression, to arrive at a "lay out" which recognizes the requirements according to their relative importance. This is really one of the most important elements, one may say the

*The photographs are taken from a model, and do not show the south wing of the Exchange.

most important element, of the "architectonic" equipment. It is that which Viollet le Duc, in his "Discourses" shrewdly and frankly recognizes as the great distinction of the Roman architects. It is not strictly an artistic quality, although it lies at the basis of artistic success in architecture. The French critic, for example, while recognizing the eminence, the pre-eminence, of the Roman builders



THE FRONT OF THE STOCK EXCHANGE.
George B. Post, Architect.

in this respect, also recognizes their inferiority to the Greeks, merely and strictly as artists. It was the "lay out," the general scheme, commonly shown better in plan and section than in elevation, that made them architects and which fact makes so idle the discussion whether, in a modern business building, the engineer should not employ the architect, instead of vice versa, as in the accepted ar-

rangement. The man who has learned how to lay out the building, and to arrange harmoniously, and with due relations of superiority and subordination, its various parts, is the real author of the building and must, in the nature of the case, employ and direct the authors of the details. Now, the training which enables a man to do this is strictly, as things are now, an architectural training, and the education of an engineer, as at present conducted, does not pretend to equip the student for it. In fact "engineer's architecture" may commonly be recognized by its ineptitude in this respect even more than by its strictly artistic ineptitude. Look, for example, at that astonishing piece of work, the New York terminal of the Brooklyn Bridge, in which the practical necessities of the case are met, after a fashion, but after such a fashion! One sees at a glance that an architect has not been there, and that he has been sadly needed.

We say that this faculty, or acquirement, is not strictly artistic. But it is at the basis of artistic success in architecure. One man who very eminently had it was Richardson, and it lay at the bottom of his artistic success. It was not by any means the Provençal Romanesque in which he happened to work, or his dwarf columns, or his exaggerated voussoirs, that made Richardson a great architect. It was his faculty for reducing his problems to their simplest expression and for emphasizing the emphatic facts of structure and arrangement. And the same "architectonic" faculty is noticeable in the works of the architect of the new Stock Exchange. One of his best works was the Chickering Hall that was pulled down only the other day, and that owed its success to the exterior expression of the concert hall as the building, and the subordination to this main feature of all the accessories and dependencies. The problem was, in fact, the same, on a very much smaller scale, as that which he has so successfully solved in the new Stock Exchange, and the solution essentially similar.

The problem was to erect a vast room (the adjective is not too big for an apartment well over a hundred feet on its shorter side and some eighty in height) which should be abundantly lighted, the lighting, in fact, being the most peremptory of its requirements. The other requirements, numerous and complicated as they were, were all subordinate to this. And this principal requirement, as nobody can help seeing who even glances at the finished front, has been made the basis of the architecture as well as of the practical plan. In fact, the architecture of the new Stock Exchange is merely "the thing itself," and that is what makes it so successful.

It was a very happy thought to employ the "order" here. Perhaps it was inevitable, and the praise due to the architect must to that extent be lessened. But at all events it looks inevitable, now

that it is done, and this look of inevitableness, that the thing could not have been other than it is, is the most satisfactory aspect a building can wear. Not even the most bigoted anti-classicist can complain when the modern architect has an opportunity to use the classic orders as the ancients used them; that is to say, as the actual construction, as "the thing itself." But that so very seldom happens. When it does happen, as in the building of the Faculty of Medicine in Paris, or in the present instance, how immensely the architecture gains in effect! The commoner method is either to build the portico outside of the building, which it darkens and makes inconvenient, as was the practice in our Greek revival of two generations ago, confining the architecture to it, and sacrificing the building to the extraneous architecture, or else to apply it to a wall which is independent of it, and with the construction of which it visibly has nothing to do. In either of these situations the plain man is disgusted with it and calls it a piece of nonsense. And the architect finds difficulty in denying that the plain man is in the right. But, if it happens that the requirements of a modern structure are such as the classic order will really supply, practically, then the medievalist must, as we say, be very bigoted indeed who does not hail the opportunity to employ the "order" in which the ancients took the simplest and most primitive of constructions, and wrought it out to a height of purity, lucidity and refinement to which more complicated constructions never attained, and which is without doubt the most perfect architectural expression ever attained by man. Lucky the modern architect to whom this rare opportunity occurs, and who, in his admiration for the works of the classic masters, does not have to resort to false pretences in order to gain the chance of reproducing what he could not produce.

This is the rare opportunity that has befallen Mr. Post in the work under consideration. His main requirement was that of a large, light and lofty room, to be illuminated from the two ends, and only incidentally from above. The ends, then, must be simply huge sash frames, of the smallest dimensions to which sash frames of masonry can be reduced, and of the most refined modelling and disposition that can be attained in the repertory of historical architectural forms. If the historical repertory did not contain the appropriate forms, then, and only then, would it be imposed upon the modern architect to devise new forms for new uses. But in this case it fortunately happens that the very thing for such a sash frame as the practical requirements indicate, and as perfectly and beautifully expresses the single "cella" of which the building actually consists, is available in the classic order. The architect who would hesitate to make use of it in such a situation would be a fool, one is tempted to say, not altogether in his haste. And one would

be tempted to say the same thing of the Goth or the eclectic who should object to the employment of a classic colonnade in a position where it so abundantly justifies and vindicates itself.

It was a very bold, but also a very just thing to do to make the whole front into this huge and single sash frame, to use colossal Corinthian columns as the mullions of an opening embracing the whole elevation. The rear elevation on New Street, of which the shafts are unfluted and the capitals at present only blocked out in the rough, is almost more impressive by dint of its very want of fin-

GROUP FROM THE PEDIMENT—"AGRICULTURE."

ish. At any rate one sees that the primary need of light has been abundantly and most appropriately met by this order, of five stories, as one discovers by the small and plain openings ranged alongside. The order would practically be as available if the space it fronts were divided into stories and were an office building instead of a monument and a temple, a place, as the scoffers say, of the most sincere worship offered in New York. But in that case it would lose all its appropriateness and all its significance. The reservation of this space at the side, and the withdrawal of the front have the

CENTRAL FIGURE OF THE PEDIMENT.

effect of an emphatic frame, which combines with the colossal scale of the order itself to detach and signalize the building.

One is bound to praise also the conception and treatment of the basement. The stories practically needed below the great hall of the Exchange just suffice to serve as an emphatic stylobate, raising the order where it can be best and most effectively viewed, and the manner in which the front has been "refused," instead of being kept in the line of the front to the southward, secures an excellent view from far up Nassau street, the vista of which is very impressively closed by the order and its pediment, and which will give a capital field for the exhibition of Mr. Ward's sculpture as well as of Mr. Post's architecture.

But it is at this point of the pediment that our praise must become qualified. The logic and sense of appropriateness which moved the architect to make his front the colonnade of a classic portico seem to have deserted him when he was inspired to complete the front of his temple with a pediment. That funny little old Parthenon, the Sub-Treasury, is made to look funnier than ever by the towering new neighbor which so outclasses and outscales and belittles it. But at least the pediment of the Sub-Treasury is the end of a roof and has a meaning, while the pediment of the Stock Exchange is entirely meaningless, when it is applied to the tall background of the attic which puts it to an open shame and shows it as a mere "survival" of a feature which had a meaning in another situation. It is sunk to be a mere and avowed frame for the sculpture. But if it had been omitted, and the attic left to tell its own story of a flat-roofed building, the frieze which would have accrued would have offered a much fairer field for sculptural decoration. No doubt the feature would have been difficult to treat. But what he has done elsewhere indicates that the architect would have been equal to the task, and he would have had the satisfaction of producing an original work, of which the originality would not have been forced or capricious, but have proceeded straight from the conditions of the problem, which are the basis of the architecture of the colonnade. It is a noble front, but it might have become yet nobler.

The fenestration of the basement is effective and dignified. But one cannot say so much for the architectural carving. The frieze of the entablature is a rich expanse of Roman foliage, apparently reproduced from a good model, and at all events in the spirit of the style. We cannot say so much for the carving of the basement. The frankly naturalistic oak leaves of the keystones of the small arches are in themselves very good in design and even exquisite in execution. But they do not belong to a Roman temple. And the feature loses much of its grace and all of its fitness when it is seen in connection with the bloated Renaissance garlands, so suggestive

of the market garden, which are draped along the lintels of the lower story. In fact, the carving of the entablature, the carving of the arches and the carving of the lintels are each incongruous with either of the others, and the incongruity takes away much of the pleasure which carving so skilful and spirited would give if the incongruities had been avoided. But these things are blemishes on a very brilliant and successful piece of work, to the author of which all New Yorkers ought to be grateful.

Montgomery Schuyler.

FRENCH SCULPTURE IN WAX.

A Modern Revival of a Lost Art.

ONE could not have a plainer indication of the growing taste for beautifying the interiors of our houses than the increasing prominence which is given annually at the Paris Salons to decorative art. Judging by the large number of exquisite objects which are on view—art, furniture, decorative panels and screens, *objets d'art* in various precious materials, and *repoussé* leather work—there has rarely been a time when the predilection for choice decoration was greater. Statuettes especially have now come to be recognized as a most essential part of the interior adornment of every refined home. Sculpture was formerly confined almost wholly to the hall and the art gallery; but we have now brought it into more intimate touch with our lives by placing it in our drawing-rooms and studies.

It is not my intention at this time to write about the silver and ivory statuettes of Barrias and others, the miniature bronze groups of Charpentier, or the classic marbles of Bartholomé—to mention only three leading French artists who are satisfying the popular taste for little sculpture; but to refer to statuettes made in a new yet old medium, namely wax. All revivals of lost arts are interesting, and few more so than the attempt which is being made by three or four Parisian sculptors to resuscitate an art in which some of the world's great artists have excelled. The production of works of art in wax dates, indeed, from the earliest times, and probably originated in Persia and Egypt, where wax was employed to embalm the dead. The Greeks are known to have ornamented their bedrooms with wax images of their children; and in the time of Alexander, when the art was wide-spread, there existed a class of artists in wax who became serious rivals of sculptors and bronze-founders in modelling the human face, animals, and natural objects of all kinds. Goldsmiths and sculptures of Italy practised the art from the 15th Century onwards and produced many masterpieces, some of which have been handed down to the present day. In the Munich art gallery is a wax descent from the cross attributed to Michel Angelo; in the Wicar collection at Lille is a wax bust of a young girl—surpassingly modelled—which has been attributed to the Florentine Orsino; and Benvenuto Cellini has left behind several fine works, including two well-known portraits of Alessandro and Francis de'Medici. In France, this interesting branch of art has

FRONT VIEW.

BACK VIEW.

"YOUTH," BY M. LÉON DELAGRANGE.

also had many celebrated adherents in the past. On the death of the kings of France, it used to be the custom to expose to public view a wax model of the monarch's face; and that of Henry IV., modelled and colored by Guillaume Dupré (1574-1662), can be seen at the present time in the Musée Condé, at Chantilly. But the most celebrated of all French sculptors in wax was Antoine Benôit,

"FEMME REVEILLANT."

By M. Léon Delagrange.

whose portrait of Louis XIV. at Versailles is the most authentic likeness of that monarch in existence.

With the example of so many eminent predecessors before him, it is not surprising that M. Stanislas Lami, who, besides being a sculptor, is an earnest enquirer into little-known by-paths of the history of art, should have been tempted to imitate them. He found, however, on commencing his work, about four years ago, that it was no easy matter to follow in their footsteps successfully. Wax

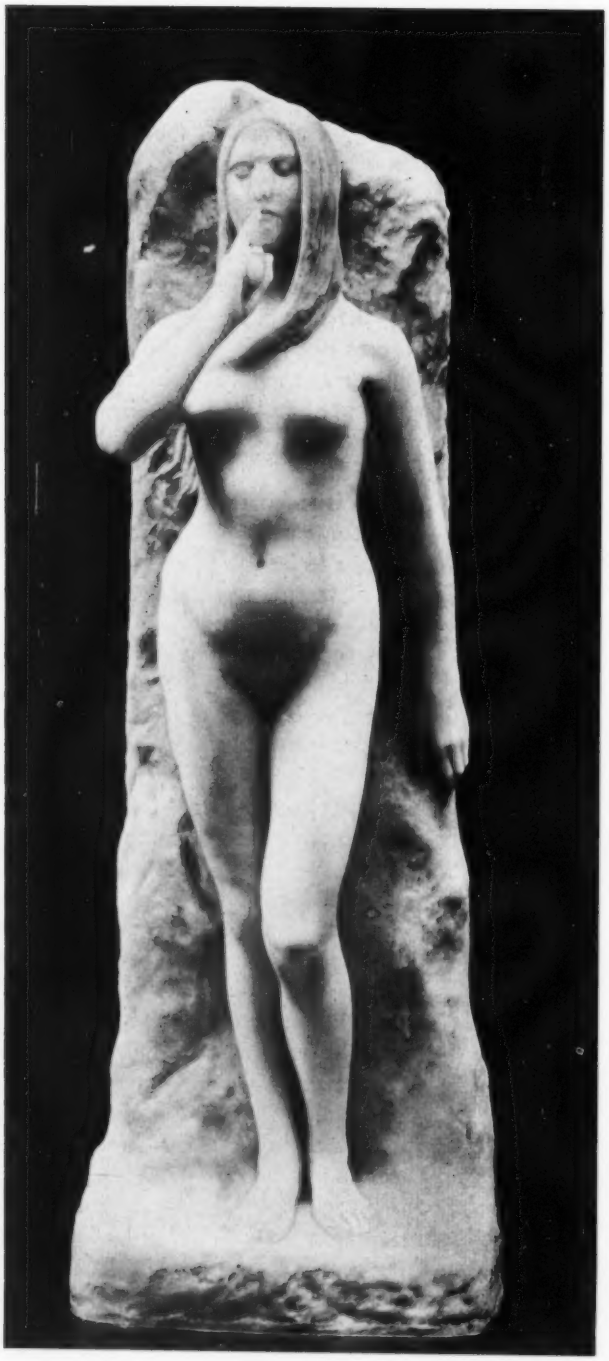
A DANCING GIRL.

By M. Léon Delagrange

A DANCING GIRL.

might be an excellent medium in which to work, owing to the facility with which it can be cut and shaped, and the ease with which it can be colored; but the method of hardening it, so as to render it durable, had been lost with other secrets of the ancients. So he set to work to learn and to experiment. For six months he did not disdain to study in the workshops of Parisian doll-makers, and, though he was told much which was useless to him, he did not fail to pick up many hints, which, with his superior knowledge as a sculptor, were of extreme value. Needless to say, however, he produced nothing but failures during the first six months he was working on his own resources; and it was not until the expiration of that time that he acquired the many *tours de main* which are necessary to introduce the melted wax (prepared and hardened by a method which is the sculptor's secret), into the various parts of the mould which has been taken from the finished clay model. When this has been done the statuette has to be finished, in much the same way as a marble statuette, with sculptor's tools warmed to various temperatures. The work from first to last has to be carried out in a studio kept at a uniform and high degree of temperature, and the statuette must be protected from all currents of cold air, which would have the effect of causing cracks and irreparably damaging it. M. Lami has from time to time exhibited his beautiful little wax figures at the Salon; but until he had a collective exhibition at the Galerie des Artistes Modernes in Paris people were unable to judge of the importance of the revival upon which he has been engaged. This exhibition included twenty-six works—one of the finest of which, entitled "Le Silence" is here reproduced—composed of imaginative subjects, busts, and portraits, tinted and colored in a manner which makes them admirably adapted for home decoration. I may add that two of this talented sculptor's works have found their way into the art collection of a well-known American connoisseur.

Another sculptor who has been highly successful in producing statuettes in hardened wax is M. Léon Delagrange. In this year's Salon des Artistes Français he exhibits two dancing girls and a "Femme reveillant," which are amongst the most charming works I have yet seen in this medium. These *danseuses* have nothing forced or unnatural about their attitudes; their loose flowing draperies express the most graceful movements of the dance. And they delight the eye as much by their color as by the exquisiteness of their form. The clinging, diaphanous robe of one of them is a delicate azure blue. Over the breast and shoulders is a jewelled and enamelled ornament from which hang three pendants terminating with long and irregular-shaped pearls. The other dancing girl is a rosy-pink throughout, and from the enamelled gold girdle around the waist is suspended a triangular ornament enclosing an opal. A



LE SILENCE.

By M. Stanislas Lami

AN OPERA DANCER.

By M. Léon Delagrange.

BUST IN HARDENED WAX.

By Mme. T. Peltier.

special beauty of these two superb examples of M. Delagrange's work is the effect which he has produced of transparent draperies. In parts the wax is almost as thin as a sheet of note paper, and makes one marvel at the technical skill of the artist. The characteristics to be seen in these exhibits at the Salon are present in all M. Delagrange's work, so there is no need to do more than draw attention to the photographic reproductions of other statuettes in wax which have not yet been seen outside his studio. Let me say that the sculptor, who was a pupil of Barrias, has only of recent years given up so much time to working in wax. He has worked in all the materials usually employed by sculptors and some of his bronzes have already crossed the Atlantic.

Mention has yet to be made of a lady-sculptor, Mme. Thérèse Peltier, who has also made a specialty of works in this novel material. She is a prominent exhibitor at the exhibitions of Women Painters and Sculptors.

The impression that wax is too fragile a material for serious works of art is at once swept away by the fact that the works of these three artists, like those of their predecessors, are, if not as durable as marble, at least as permanent as terra cotta. Wax hardens with age, Benoit's portrait of Louis XIV., at Versailles, which is unprotected by glass, being almost as hard to-day as a piece of marble. If modern works are placed under glass covers, it is not on account of extreme fragility but to protect them from accidents and dust. When these facts become thoroughly understood statuettes in hardened wax will become almost as popular in the ornamentation of our interiors as those in other materials.

Frederic Lees.

THE ABDUCTION OF IPHIGENIA.

M. Soulés, Sculpture.

"PROGRESS LEADING ON COMMERCE AND INDUSTRY."

By Dalou.

THE "BIG STORE" OF PARIS.

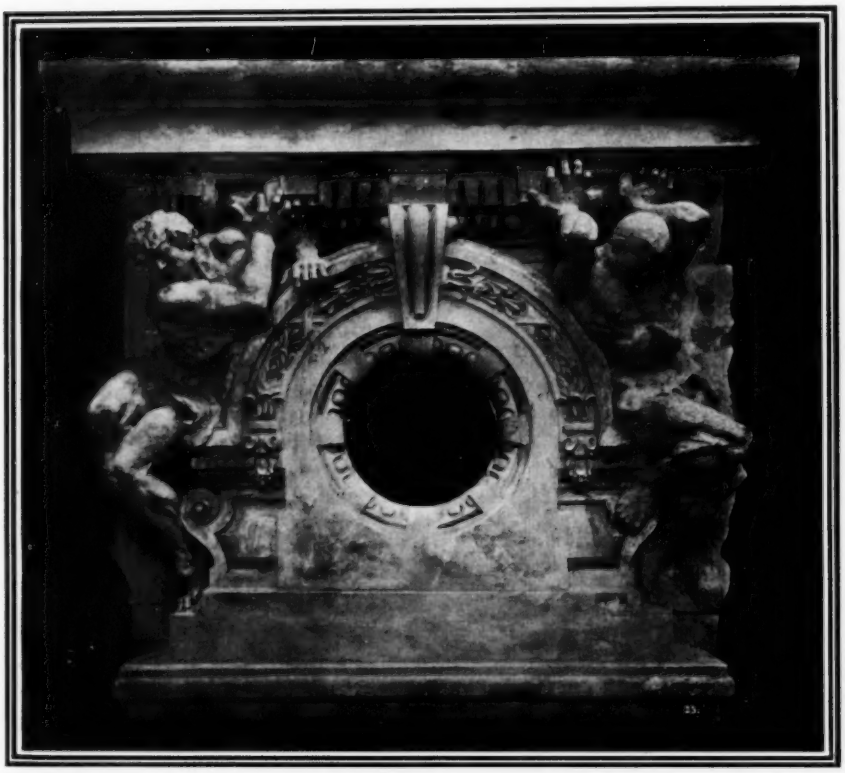
Dufayel's Establishment.

TWO powerful searchlights can be seen from all quarters of Paris every night. One is that of the Eiffel Tower and the other, which is almost as powerful, is that of Dufayel's store, one of the most interesting centers of French commerce, both on account of its magnificent decoration, and because of the system of business practiced there.

It is a credit system. For a small sum—generally the fifth of the whole price—anybody can purchase whatever household goods he may require, and settle the balance by weekly installments varying from thirty cents to four dollars. But it is not only to these facilities of payment that the Dufayel establishment owes its rapid success, but more especially because the customers are fully aware that they will not have to pay more in purchasing on credit than if they paid ready money. This system of payment by instalments is appreciated, therefore, by both rich and poor, and more than three million customers have placed orders with the firm, three thousand clerks are employed in booking and sending off these orders, which amount to $26,000,000 in the course of the year.

In order to attract and retain this vast custom, M. Dufayel has not hesitated to expend large sums, and has built on a large piece of land, measuring thirty-eight thousand square yards, an enormous store, 130 feet high, divided into floors, separated into courts, and

MAIN PORCH AND ENTRANCE TO "DUFAYEL'S."



CARYATIDES ON THE FACADE.

By Falguière.

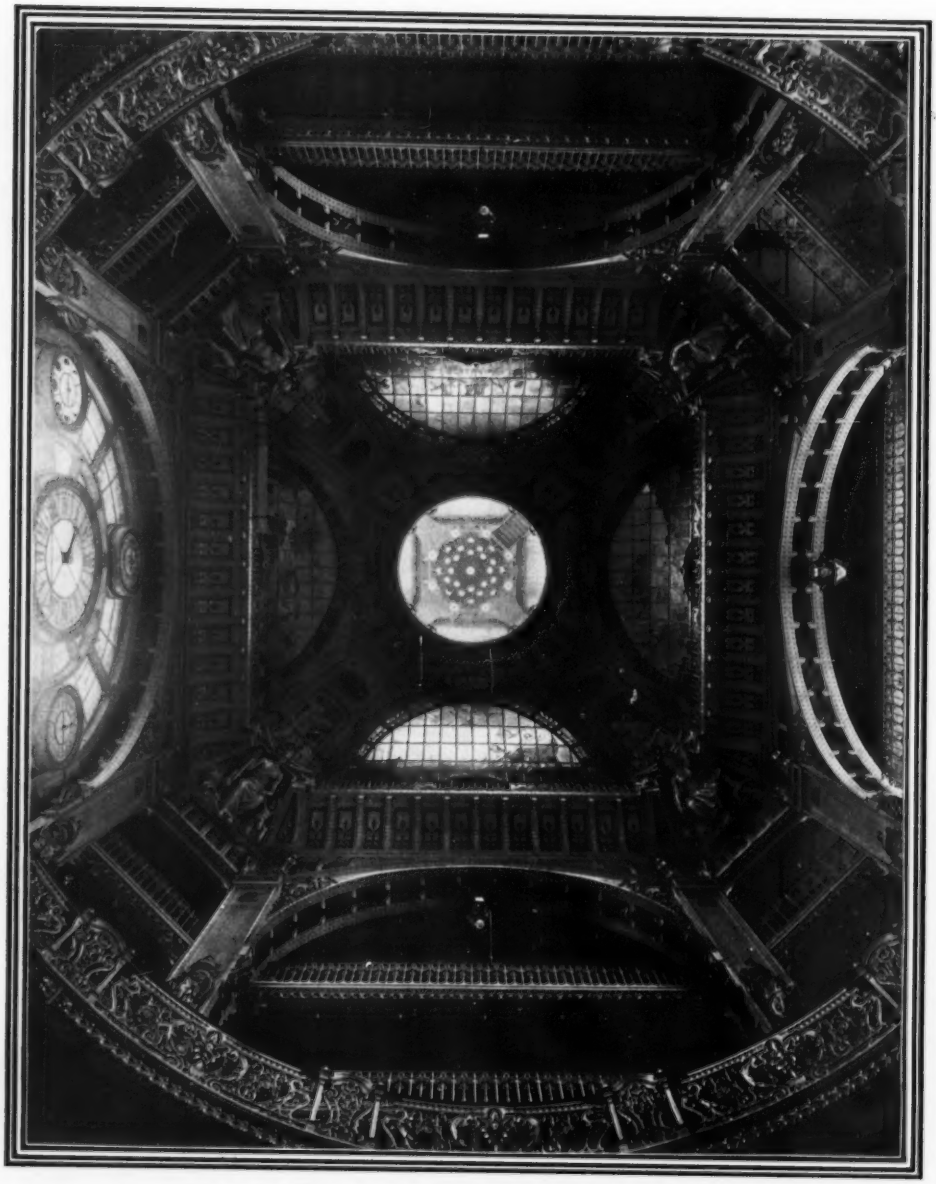
decorated with a profusion of statues and paintings by great modern artists.

On entering Dufayel's store by the principal door, in the Rue de Clignancourt, it seems as though you were entering a palace rather than a shop. The porch, which is twenty-three feet wide by thirty feet high, is ornamented with carvings and statues, and surmounted by a dome, the cupola of which rises to a height of one hundred and eighty feet. On each side of the doorway is a bronze group seven feet high on a stone pedestal. They are by Falguière, and represent "Credit" and "Publicity." The same artist has also sculptured the caryatides which ornament the circular openings to the right and left of the clock—a wonderful piece of horology, which cost more than three thousand dollars and which shows the hour, day, etc., on a face seven feet in diameter. Above the clock is an enormous bas-relief in stone by Dalou, fifteen feet high, and forty-five feet long, representing "Progress leading on Commerce and Industry." In front of the façade is a railing 120 feet long by

By Falguière. "CREDIT."

"LA PUBLICITÉ."

By Falguière.



VIEW OF THE DOME FROM BELOW.

INTERIOR OF THE DOME, WITH CHARPENTIER'S "PARIS."

THE DOME AND THE SEARCHLIGHT.

thirteen feet high in wrought iron, weighing ten tons and furnished with machinery to raise it at night and lower it in the morning, worked by either hand, electric, or hydraulic power.

The interior of the dome is quite as remarkable as the outside. It is entirely constructed of iron, steel, and bronze, like the rest of the building, in which wood is employed as little as possible. The dome is supported by pillars covered with bronze plates representing laurel leaves across a bronze network. The pillars, which end in bronze caryatides, by the sculptor Hexamer, support the balcony of the second floor. The hip-rafters are ornamented with four sculptured figures; "Paris," by Charpentier; "Lyon," by Daillon; "Marseilles," by Leroux, and "Bordeaux" by Oger. Between the hip-rafters are four large decorative panels, painted on glass, after cartoons by Clairin, which enhance the general effect, and which represent "Art," "Commerce," "Science," and "Industry." Two bronze figures holding candelabra by Falguière and Dubois, some bronze masks and decorative figures, complete the decoration of the dome, which is painted in light colors and forms an attractive looking entrance to the store. Inside the cupola is a large cut-glass chandelier. On the top of this dome is a revolving light, of ten million candlepower, which can be seen at a distance of twelve miles, and which cost four thousand dollars to construct, and which makes an excellent advertisement at night.

Going rapidly through the store, we pass successively the central hall, part of which is occupied by one of the most striking architectural features of the building, a large staircase with four branches, in the construction of which several severe difficulties had to be overcome. The staircase is independent and constructed on four arches, thirty-three feet wide; each of the four branches is ten feet wide. The accompanying illustration gives a general idea of one of the three landings. The upper part of the staircase is ornamented with painted glass windows by Champigneulle, representing "Thrift," "Confidence," "Abundance" and "Labor."

On leaving the central hall we come to one of the most famous attractions of the establishments—the theatre, where, every month, M. Dufayel gives a grand musical entertainment to his customers. It is a room 112 feet long by 46 feet wide, and can contain three thousand spectators in the stalls and boxes. The stage is 52 feet high, 46 feet wide, and 23 feet deep. It will contain 200 performers, and is decorated with mirrors forty feet high and twenty-three feet wide, a gilded proscenium magnificently sculptured with figures of "Commerce" and "Industry," an embroidered silk-plush curtain, and wreathes of foilage in white and gold on pale green completing the decoration of the hall, which is an object of astonishment and admiration to all visitors.

VIEW OF THE GREAT BRANCHED STAIRCASE.

VIEW OF THE SECOND LANDING ON THE GRAND STAIRCASE.

Close to the theatre is the old *salle des fêtes*, 165 feet long and 72 feet wide, divided into two by a gallery in the form of a loggia, ornamented with marble columns and caryatides sculptured by E. Leroux. The hall is covered by a glass ceiling, transparent by day and lighted by three thousand electric lamps at night. This ceiling, 550 square yards in extent, is covered with designs in burnt glass after cartoons by H. Berteaux, representing "Day Chasing Away the Night," and—to right and left of this—"Morning," "Evening," "Dew" and "Dawn Accompanying Apollo, the god of Light." This extremely interesting piece of glass-work took two years to execute.

Passing through the shop, we come to the reception hall, which the proprietor of the establishment has had decorated most luxuriously and artistically. The compartments of the ceiling are decorated in high relief, and deserve attention. Then we pass into the "Hall of the Seasons," decorated with allegorical figures by Lalou and further ornamented with a profusion of gold wreathes and garlands. In one of the galleries of the same hall should also be noticed the painted ceramics after Luc Olivier Merson, and painted glass after Renaissance patterns. We then come to the Cinematograph Hall, the most popular of all the attractions of the establishment.

The hall in which the cinematograph is installed is in the basement, and is simply decorated with mirrors and stucco columns. The fifteen hundred persons who assist at the four performances, of one hour each, every day, do not come to see splendid decorations, but to behold all the events of the day represented. Visitors have to pay a certain admission fee, varying according to the subjects represented. The cinematograph attracts many people to the store, and is an ingenious and profitable method of advertising.

If the theatre, the salesrooms ,and reception rooms are furnished and decorated with a luxury which borders on profusion, the packing rooms and clerks' offices are, if less luxurious, arranged in a practical and thoroughly modern manner.

There are 250 mahogany desks, occupying an immense gallery in which the customers, seated in arm-chairs, await their turn to pay their instalments or to receive the "credit notes" they have applied for. For Dufayel does not sell clothes, underlinen, and many other articles directly to his customer, but gives, in return for a small instalment, an order on one of the four hundred shops which he has business connections. For such goods Dufayel pays the seller cash and recoups himself by the weekly payments. He is thus a kind of banker, but a banker who is content with a very small profit on each transaction, and which he makes not on the sale

THE THEATRE.

price but on the purchase price by getting a fair discount from the seller by paying cash down.

It is by this system, which is based on strictly honest commercial principles, that M. Dufayel has made a fortune—a large fortune. Every day 1,800 customers apply at the desk for 24,000 dollars worth of "credit notes," and 16,000 dollars is paid as instalments on 600 sets of furniture. Eight hundred cashiers start out every day to receive instalments paid at customers' houses. Each of these clerks calls at 200 to 250 places, and though the sums are sometimes not more than thirty to forty cents the eight hundred clerks bring home every night from $40,000 to $42,000. When they return they verify their accounts with eight hundred lady clerks, take note of fresh customers, etc., and there are very rarely any bad debts. They form an insignificant minority, and, though it may appear strange, considering the modest means of the greater number of purchasers, the whole of Dufayel's legal business is performed by four clerks.

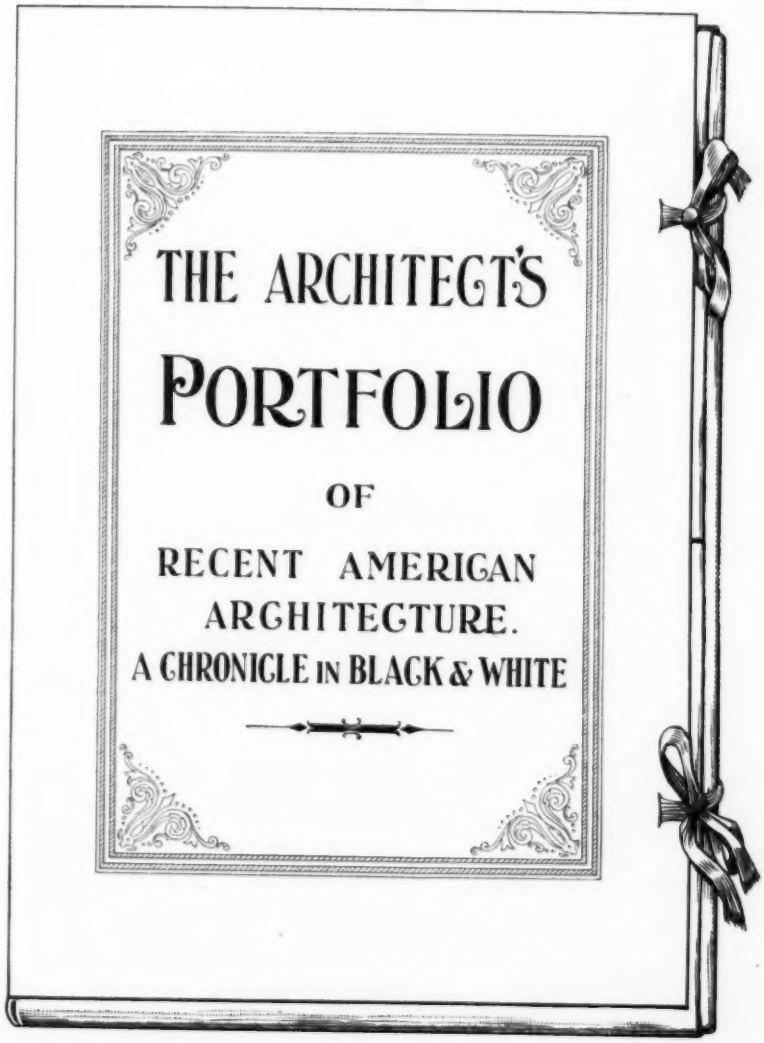
Not the least interesting thing about this vast establishment is that, though selling on credit and to the poorer classes, it owes its reputation to the splendor and the enormous sums which have been expended on it. The buildings cost $9,400,000, of which the dome alone cost $1,200,000, and the statues $800,000. Decorations were $100,000. At night the store is illuminated by 11,000 incandescent lamps and 350 arc-lights. On the walls there are two hundred statues and one hundred and fifty pictures, and every day three thousand clerks display to customers five million dollars worth of goods; complete drawing-room sets from $19 to $4,000; dining-room sets, from $60 to $1,900; bedroom sets, from $39 to $1,200, and dinner services from $3.40 to $90. Also an infinite variety of household goods, which the poor can now obtain on credit and which they would be compelled to go without if they had to pay ready money.

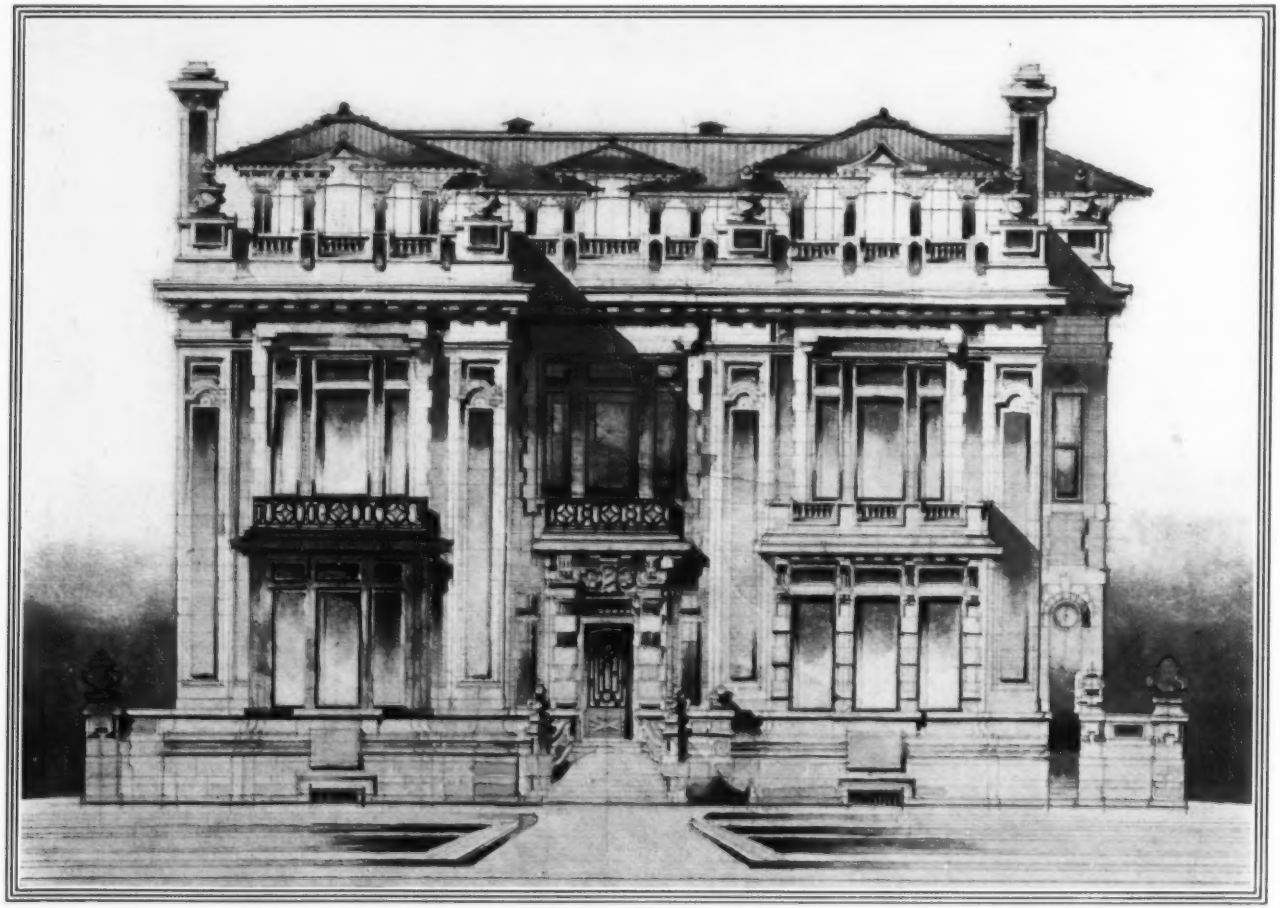
In the stables—an immense building of five stories, splendidly fitted with all the appliances of modern hygiene—two hundred horses, and a hundred and eighty carts are always ready to deliver goods.

The *magasin* was built in eighteen months from the designs of M. Rives, who is also entrusted with the direction of the almost continual enlargements and improvements.

Besides this huge store, M. Dufayel runs an advertising and bill-posting business, and a house and estate agency, which bring in a good profit, and also serve to advertise his store, the magnificence of which attracts customers and the advantages and amusements of which help to retain them.

Pierre Calmettes.


THE ARCHITECT'S
PORTFOLIO
OF
RECENT AMERICAN
ARCHITECTURE.
A CHRONICLE IN BLACK & WHITE



THE SEMINOLE CLUB.

Jacksonville, Fla.

Snelling & Potter, Architects.

Thompson, Conn.

RESIDENCE OF NORMAN REAM, ESQ.

Shepley, Rutan & Coolidge, Architects.

Fair Haven Heights, Conn.

THE KING HOUSE.

W. H. Allen, Architect.

Situated on York Square.

A NEW HAVEN HIGH SCHOOL.

Brown & Von Bern, Architects.

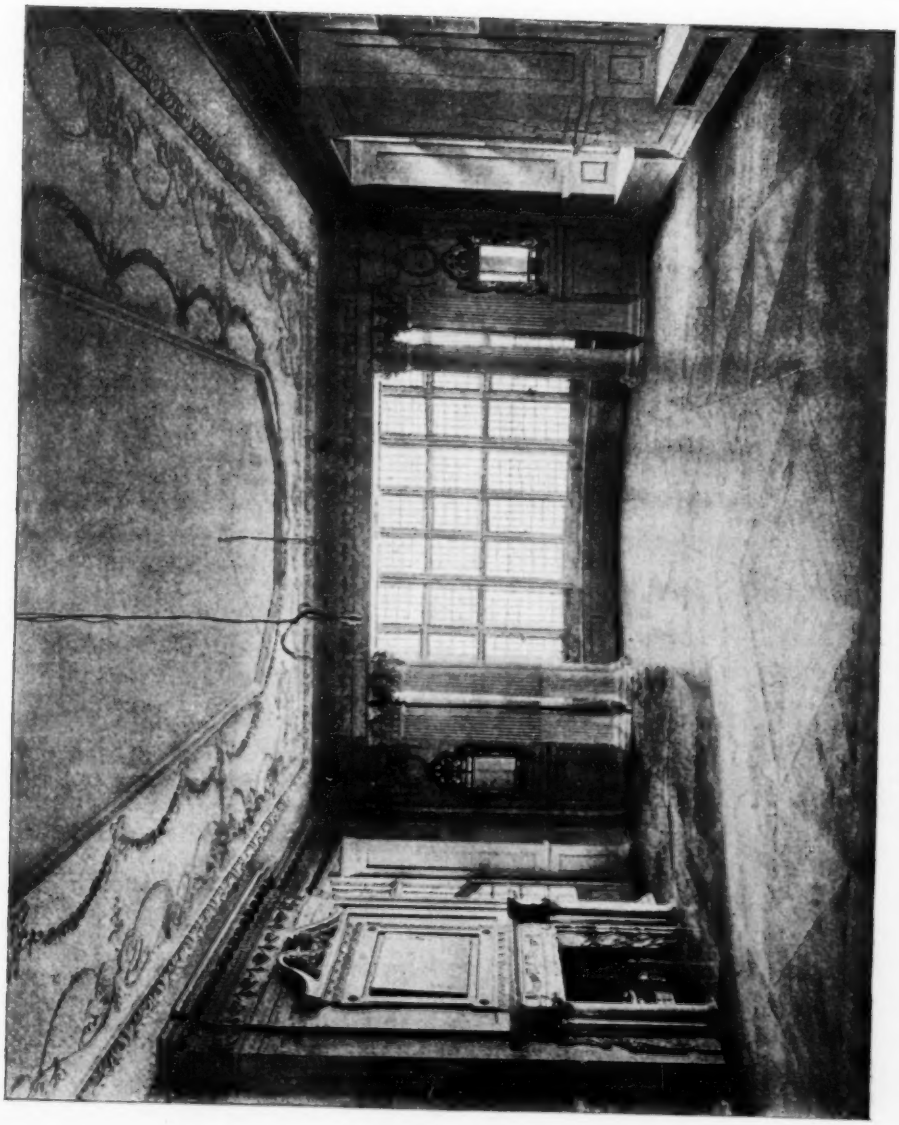
ALBANY TRUST CO.

Albany, N. Y.

Marcus T. Reynolds, Architect.

RESIDENCE OF J. N. JAROS, ESQ.
No. 266 West End Ave., New York City. R. L. Daus, Architect.

BROAD STREET NATIONAL BANK.
Trenton, N. J. W. A. Poland, Architect.



DRAWING ROOM, ASHORNE HILL HOUSE. E. Goldie, Architect.

Near Leamington, England.

APARTMENT HOUSE.

Berlin. A. F. M. Lange, Architect.

APARTMENT HOUSE.

No. 58 Klopstockstrasse, Berlin, Germany. A. F. M. Lange, Architect.

Opinions Official and Unofficial.

The Improvement of Washington.

During the past ten years the standards which control the action of the national government in aesthetic matters have most wonderfully improved. Only a decade ago Washington was almost the headquarters of American aesthetic barbarism. The buildings erected by the government in all parts of the country were practically designed by draughtsmen in the office of the Supervising Architect, and did not have the merits even of good school work. The Administration Building at the Chicago Fair had been the one palpable and inexcusable architectural failure of the Exposition. The Government buildings most recently erected at Washington had been both situated irrespective of any general plan, and had been incongruously and clumsily designed. The Congressional Library had been given a location in which it "neither confronted the Capitol nor preserved any reciprocity of sight with it, and where it stopped one of the west vistas carefully arranged by L'Enfant to be closed by the Capitol." In short, the improved aesthetic standards which were noticeable in private architecture of the large cities had failed at that time to sift through the various layers of American life and infect its central organization. The large aesthetic problems of a great nation were managed in a spirit mixed of anarchy and obscurantism.

But during that ten years an immense and most salutary change has taken place. The Congressional Library itself, while most ignorantly situated, turned out to be a useful agent in stimulating interest in the aesthetic improvement in our national capital, for the mural decoration of that edifice instantly attracted attention and aroused people to the fact that the national capital might and should be made more interesting to other people than office-holders and seekers. Then the Tarsney Act, while only optional, was an excellent beginning in the difficult work of securing a higher level of design for public buildings. And finally, the plan of the commission for the improvement of the park system of the District of Columbia has been received with such general favor that it has not only enormously bettered the prospects of having all future public building and park improvements in Washington arranged and in some measure designed according to a general plan, but it has also tended perceptibly to raise all along the line the standards of government action in aesthetic matters. Of course there have been Senators and Representatives

whose enlightened vision could see nothing in the plans of the commission but a scheme to spend unnecessarily a great deal of public money; but fortunately the influence of such commercial ideas upon public aesthetic policy is becoming constantly smaller. With the intensification of national feeling there grows and spreads an increased pride in the national capital and an increased desire to have that pride symbolized by appropriate public monuments.

Fortunately President Roosevelt, more than any other man in public life, has both a generous and well-informed national spirit and certain definite standards of aesthetic amelioration. It is by no means accidental that the wife of this President is the first mistress of the White House to whom the present interior of that official dwelling was intolerably vulgar, and who has had the good sense and good taste to make an attempt at refurnishing and renovation. If her plans prevail, its interior will be restored to its primitive Colonial simplicity and decorum. While such influences as these are powerful at Washington, the advocates of aesthetic amelioration should press their advantage. The American Institute of Architects at its Buffalo meeting last fall adopted two resolutions which indicate the next important steps to be taken. One of these resolutions looked toward the creation of a national Art Commission, and the other toward the formation of a national bureau of architecture, under whose administrative charge should be placed the architectural work of all departments of the national government. Could Congress ever be persuaded to legislate along the lines of these resolutions the maintenance of high aesthetic standards by the national government might be considered secure.

Although it may take Congress some time to make up its mind to take such radical and definite steps as these, it can scarcely in the long run refuse to do so. A permanent national Art Commission, with certain powers of supervision, and, it is to be hoped, also a certain initiative, is an obvious and conservative piece of machinery. It would serve both to protect the national capital against the occasional raids of Congressional or executive barbarians, and it would be a powerful and permanent force devoted particularly to the actual carrying out of the plans of the advisory Washington Park Commission. It is quite in the line of the development of administration machinery in other departments of the national government that a commission should be constituted for a special purpose, such as the aesthetic supervision of the national capital. Congress is really as unfitted to legislate upon such a matter without expert assistance. The formation of a national administrative bureau to take charge of government architectural work is an equal necessity. The national government is a great builder. Its post offices and custom houses are frequently the most conspicuous

buildings, in the smaller cities of the country. The design of these buildings should be turned out under a system that will secure buildings of a high degree of excellence, while at the same time flexible enough to give local architects their fair chance of securing the work; and such an excellence can be secured by a constitution of a national architectural bureau, working under a mandatory revised edition of the Tarsney Act. Then the national government would be in a position to lead and encourage the progress of American architecture towards a uniformly high level of design. It may take a good many years and a great deal of aggressive agitation to bring about this result, because Congress and the American politician generally have by no means as yet gotten over their disposition to resent as an impertinent intrusion all attempts on the part of specially qualified experts to control such an easy job as the mere erection of a government building. But the stars in their courses are in favor of the reformers. Every wholesome tendency in American life is fighting on the side of specialized organization, and in the end the politicians will have to succumb.